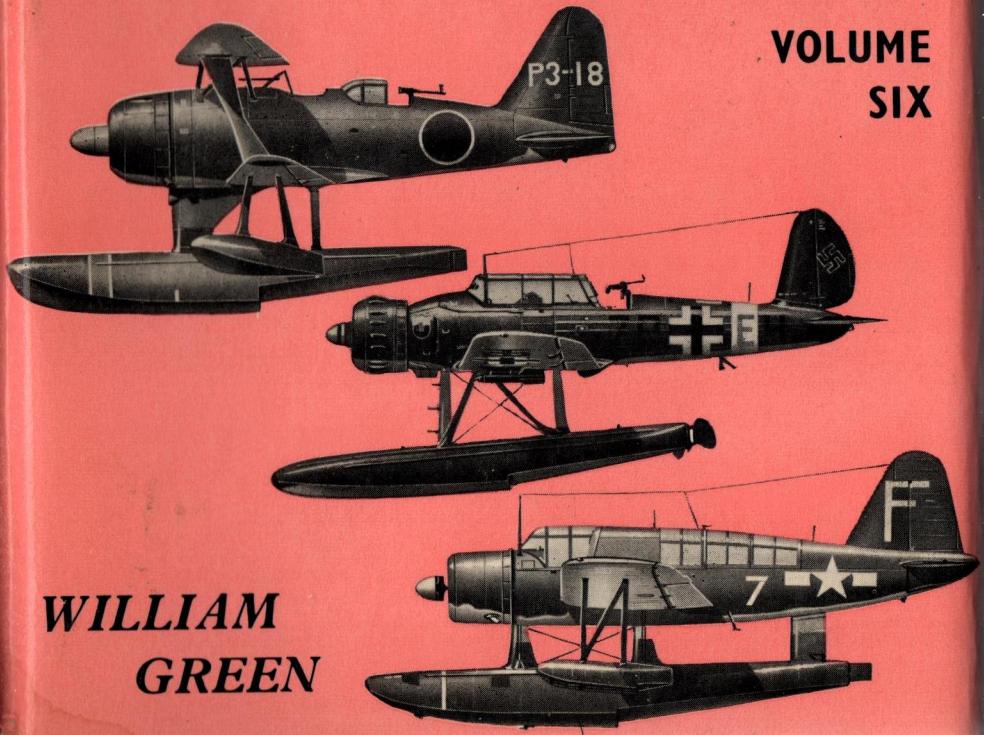
WAR PLANES OF THE SECOND WORLD WAR

FLOATPLANES

VOLUME SIX



WILLIAM GREEN

FLOATPLANES

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WAR PLANES OF THE SECOND WORLD WAR

by

William Green

Volume VI

FLOATPLANES

As with flying boats, floatplanes of the Second World War were little publicised, although their tasks ranged from interception and torpedo-bombing to shipboard reconnaissance and patrol. The floatplanes of the Luftwaffe proved particularly troublesome in the Channel and North Sea during the early war years; they provided the eyes of the U.S. Navy in the Pacific where the Japanese—perhaps the leading exponents of floatplane design—used such warplanes extensively, and they were employed to some extent by every major combatant. This volume includes details, photographs and drawings of more than sixty types of floatplanes produced by a dozen countries.

WAR PLANES FLOAT PLANES 6

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WAR PLANES OF THE SECOND WORLD WAR

FLOATPLANES

VOLUME SIX

WILLIAM GREEN

With Drawings by Dennis I. Punnett

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INTRODUCTION

Catapulted from surface vessels ranging from seaplane tenders to merchant cruisers; launched from submarines, and flown from lagoons, lakes, harbours and other sheltered stretches of water, float seaplanes were employed by virtually every participant in the Second World War, both large and small. Their tasks ranged from gunnery spotting, reconnaissance and air-sea rescue to anti-submarine patrol, torpedo-bombing attack, and even ground support and interception, but they saw little publicity and their part in the conflict is rarely recalled today.

A few float seaplanes of the Second World War are comparatively well-known, being linked with particular exploits, such as the Swordfish which, catapulted from H.M.S. *Warspite*, spotted for the guns of British vessels during the Second Battle of Narvik, resulting in the destruction of a force of seven enemy destroyers; the Vought OS2U-3 which taxied across forty miles of rough sea to carry Captain Eddie Rickenbacker and his crew to safety in the South Pacific, and the Seafox which played such a vital role in the destruction of the *Admiral Graf Spee*. Less well-known are the exploits of the ageing Heinkel He 59 which ferried troops to the centre of Rotterdam to capture the main bridge and which, bedecked with red crosses and civil identification letters, fitted in with its more humane activities the direction of Luftwaffe dive bombers in the channel and the laying of mines in the Thames Estuary, or the Latécoëre 298 which dive-bombed road junctions and bridges between Boulogne and the River Somme in the face of heavy fighter opposition and ground fire.

These are but a handful, however, of the more than seventy different types of float seaplane employed operationally or tested by one or other of the combatants during the war years, and described in this, the sixth volume of *War Planes of the Second World War*; floatplanes of ten countries ranging in size from the diminutive submarine-borne Besson MB-411, Arado Ar 231 and Yokosuka E14Y1 which could be assembled or dismantled in a matter of minutes, to float conversions of such well-known transports as the Douglas C-47 and the Junkers Ju 52/3m. A number of types of shore-based aircraft were fitted with floats, including such fighters as the Spitfire, the Zero-Sen, the C.R.42, and the Wildcat, and these are to be found in the pages that follow, together with shore-based versions of aircraft most widely used in floatplane form.

As with previous volumes in this series, I should like to record my indebtedness to many friends and colleagues who have supplied information or photographs, including Shorzoe Abe, Dr. Rosario Abate, Giorgio Apostolo, Giorgio Bignozzi, Richard M. Bueschel, Peter M. Bowers, Warren M. Bodie, Dr. Hervé Cras, J. Cuny, Fred C. Dickey, Odd Arnesen, Hal Andrews, Bart van der Klaauw, Zoran Jerin, Pierre Leyvastre, Jacques Tiziou, H. A. Somberg, Eiichiro Sekigawa, Gordon S. Williams, Tullio Marcon, Gert W. Heumann, the Historical Section of the French Navy, and the photographic department of the Imperial War Museum.

London, October 1962 WILLIAM GREEN

FAIRCHILD (BRISTOL) BOLINGBROKE III

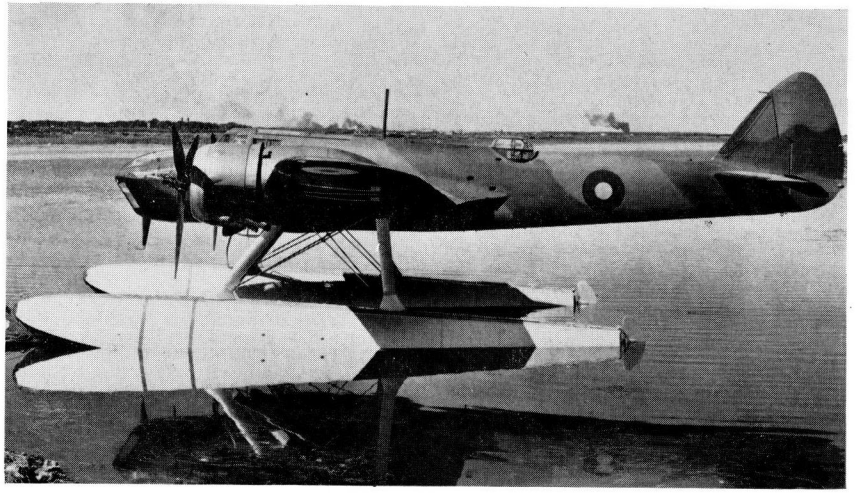
CANADA

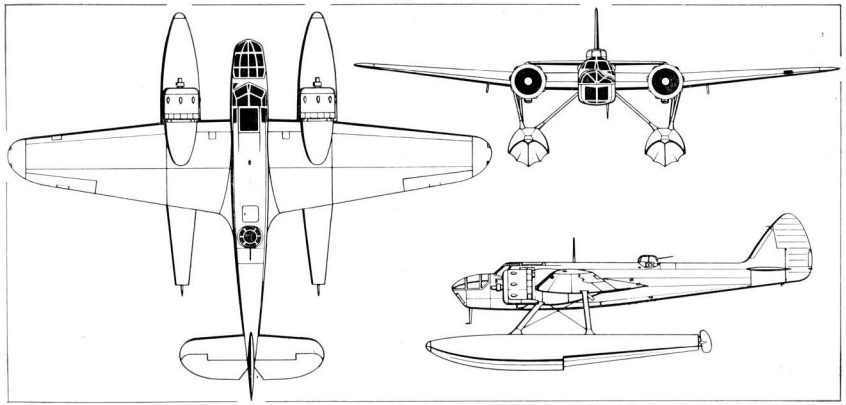
Originally derived from the Blenheim I for the R.A.F., the Type 149 Bolingbroke was adopted by the R.C.A.F., the Canadian government placing an initial contract for ninety-seven machines with Fairchild Aircraft Limited at Longueil in 1938. The prototype Bolingbroke was, in fact, an early production Blenheim I (K7072) set aside for conversion in 1937 and flown for the first time on September 24th of that year. This aircraft was shipped to Canada to assist Fairchild in the production of the Bolingbroke.

Although generally similar in appearance to the Blenheim IV, the Bolingbroke was modified to meet Canadian climatic conditions and re-designed extensively to U.S. standards and for U.S. and Canadian equipment, and an interchangeable wheel, ski or float undercarriage was specified so that the aircraft could operate in the coastal reconnaissance role from land bases or sheltered harbours and lakes. The first eighteen aircraft built by Fairchild were essentially replicas of the Bolingbroke prototype, and were powered by Mercury VIII engines, but one was fitted with twin Edo-designed floats and Mercury XV engines as the Bolingbroke III. The large, single-step all-metal floats were mounted beneath the engine nacelles, these being braced to the wing spars immediately outboard of the engine nacelles and to the wing roots by parallel struts. Defensive and offensive armament remained the same as those of the Bolingbroke I landplane, and although flight trials were successful, the drag of the floats and their bracing struts seriously reduced overall performance, and no further examples of the Bolingbroke III were produced.

Full details of the various landplane versions of the Bolingbroke are included in Volume VII.

Only one example of the Bolingbroke III was produced (Serial No. 717), this being a conversion of one of the initial production batch of eighteen Bolingbroke Is built by Fairchild.





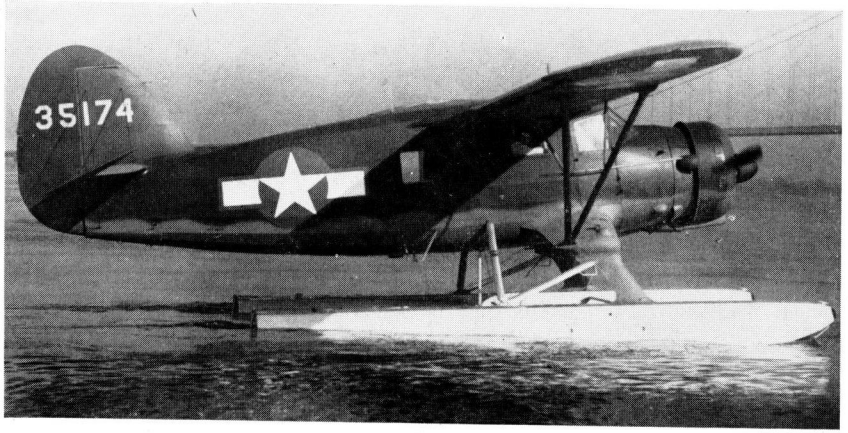
Type: *Three-seat General-purpose and Reconnaissance-bomber Twin-float Seaplane.* **Power Plants:** *Two 995 h.p. Bristol Mercury XV nine-cylinder radial air-cooled engines.* **Armament:** *One fixed forward-firing 0.303-in. Browning machine gun and one 0.303-in. Vickers K machine gun in semi-retractable Bristol dorsal turret plus a 1,000-lb. bomb load.* **Performance:** *Maximum speed, 241 m.p.h. at 12,000 ft., 233 m.p.h. at 15,000 ft.; initial climb rate, 1,140 ft./min.; time to 5,000 ft., 4.8 min., to 10,000 ft., 10 min.; service ceiling, 23,800 ft.* **Weights:** *Empty, 13,400 lb.; normal loaded, 14,800 lb.; maximum overload, 16,900 lb.* **Dimensions:** *Span, 56 ft. 4 in.; length, 45 ft. 6 in.; height, 18 ft. 0 in.; wing area, 469 sq. ft.*

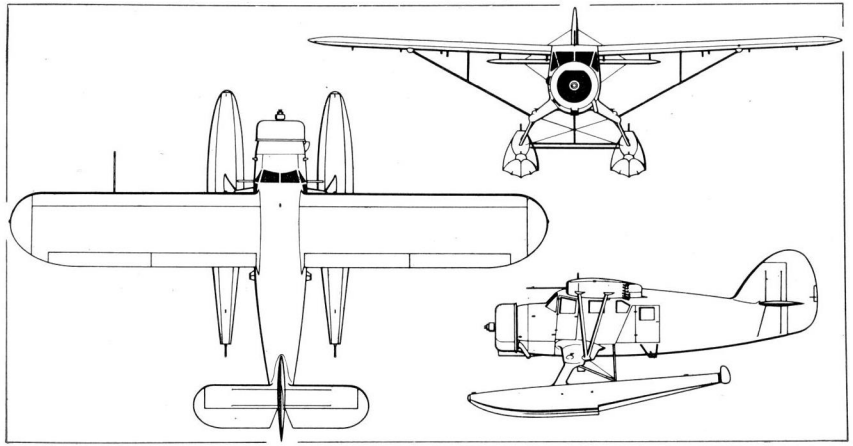
NOORDUYN NORSEMAN V — CANADA

The best-known and most widely-used of Canadian wartime aircraft, the Norseman light transport designed by R. B. Noorduyn, was flown for the first time in 1935 with a Canadian Wright R-975-E3 nine-cylinder radial. Designed specifically for Canadian operating conditions, the Norseman had interchangeable undercarriages, stubs attached to the fuselage and braced to the wings by sloping V-struts taking cantilever oleo legs for wheels, attachments for Edo Type Ya floats, or Canadian-designed skis, a change of undercarriage merely demanding the removal of two bolts from each fuselage stub.

Several versions of the Norseman were built for bush operators, the Royal Canadian Mounted Police, and the R.C.A.F. Thirty-eight Norseman IVs were delivered to the R.C.A.F. as radio and navigational trainers for use in the British Commonwealth Air Training Plan, and seven Norsemen were delivered to the U.S.A.A.F. in 1942 under the designation YC-64 for evaluation as a ten-seat utility transport. Six additional aircraft equipped with Edo floats were ordered under the designation UC-64B for use by the Corps of Engineers, and before the end of 1942, the Norseman had been accepted for large-scale use by the U.S.A.A.F. as the C-64A. The C-64A was known to Noorduyn Aviation

This Norseman (43-5174) *was one of a number of C-64As fitted with Edo Type Yd floats.*





Limited as the Norseman V, this model having a Pratt and Whitney R-1340-AN1 Wasp rated at 600 h.p. for take-off and 550 h.p. at 5,000 ft. Of mixed construction, it employed a fabric-covered welded chrome-molybdenum steel-tube fuselage, and the wing structure comprised spruce spars and ribs with a duralumin-covered leading edge and fabric covering aft.

The U.S.A.A.F. placed orders for a total of 749 C-64A utility transports, three of which were transferred to the U.S. Navy under the designation XJA-1. Thirty-four of these were supplied to the R.C.A.F. under Lend-Lease, and Brazil also received seventeen C-64A transports under this programme. A further twenty-six C-64As were supplied to various Allied countries under Lend-Lease. Although used mostly with a wheel undercarriage, a number of C-64As were operated with standard Edo Type Yd floats, and the following specification applies to the float-equipped C-64A Norseman.

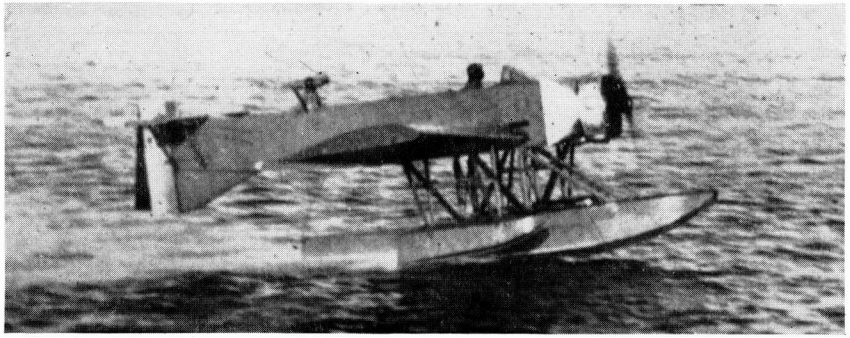
Type: *Ten-seat Utility Transport Twin-float Seaplane.* **Power Plant:** *One* 600 *h.p. Pratt and Whitney R-*1340-*AN*1 *Wasp nine-cylinder radial air-cooled engine.* **Performance:** *Maximum speed,* 148 *m.p.h. at* 5,000 *ft.; cruis ng speed* (75% *power*), 130 *m.p.h. at* 5,000 *ft.; time to* 5,000 *ft.,* 8.2 *min.; service ceiling,* 16,400 *ft.; range* (*with standard tankage at* 75% *power*), 550 *mls.* **Weights:** *Empty,* 4,890 *lb.; loaded,* 7,400 *lb.* **Dimensions:** *Span,* 51 *ft.* 8 *in.; length,* 33 *ft.* 1 *in.; height,* 17 *ft.* 0 *in.; wing area,* 325 *sq. ft.*

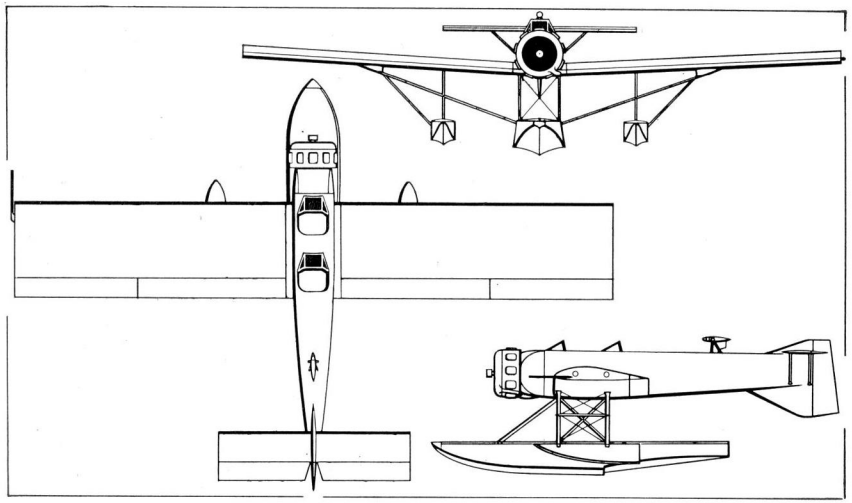
BESSON MB-411 FRANCE

The Besson MB-411 observation float seaplane was designed specifically for operation from the submarine *Surcouf*, and owed much to the earlier submarine-borne MB-35 Passe-Partout also designed by Marcel Besson. The prototype, the MB-410-01 ordered on August 24, 1932, was powered by a 130 h.p. Salmson 9NC air-cooled radial, but this aircraft was destroyed in 1933 when undergoing official acceptance trials at Saint Raphaël, and therefore a second prototype was ordered but, owing to the disbandment of the Marcel Besson company, this machine was built by the ANF-Les Mureaux and designated MB-411.

Flown for the first time at Les Mureaux in June 1935, the MB-411 differed from the first prototype in having a 175 h.p. Salmson 9ND, and was of mixed construction. It was designed to be housed in a cylindrical hangar of 6.56 ft. diameter and 22.96 ft. length aft of the *Surcouf*'s conning tower, and could be disassembled rapidly for stowage. Assembly required four minutes from the time the MB-411 was removed from its hangar, and the aircraft was lowered to the water and retrieved by crane. The MB-411 underwent official acceptance trials in August 1935 and was subsequently delivered to the *Surcouf* for proving trials. However, during a cruise aboard the *Surcouf* during the last months of 1935, several modifications were found to be necessary, and the MB-411 was returned to the ANF-Les Mureaux at the beginning of 1936.

Completed as a single-seater, the MB-411 was now converted to two-seat configuration, and after further trials at a loaded weight of 2,249 lb. which were completed at the end of May, the aircraft was returned to the *Surcouf*. On June 11, 1936, the Admiralty requested a second MB-411, an order for which was placed on February 10, 1937, and this was under





construction in the following July when the first machine completed its final trials successfully.

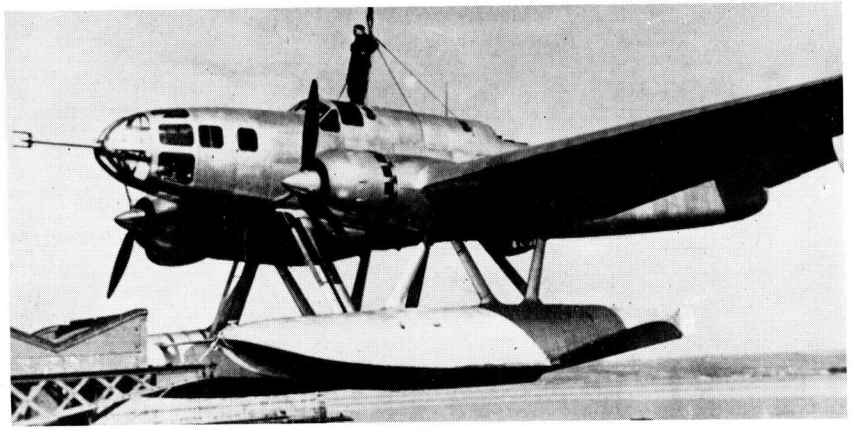
One of the MB-411s was aboard the *Surcouf* when the submarine sailed from Brest for Plymouth on June 18, 1940, and this aircraft flew several times from Poole Harbour, Dorset. It was subsequently damaged during a Luftwaffe attack on Plymouth where it was being stored before re-embarking aboard the *Surcouf*. In consequence, when the submarine sailed from Plymouth on May 10, 1941, it had no aircraft aboard. The *Surcouf* was subsequently sunk after a collision at night with an American merchantman in the Caribbean, and the fate of the MB-411 that remained in France is unknown.

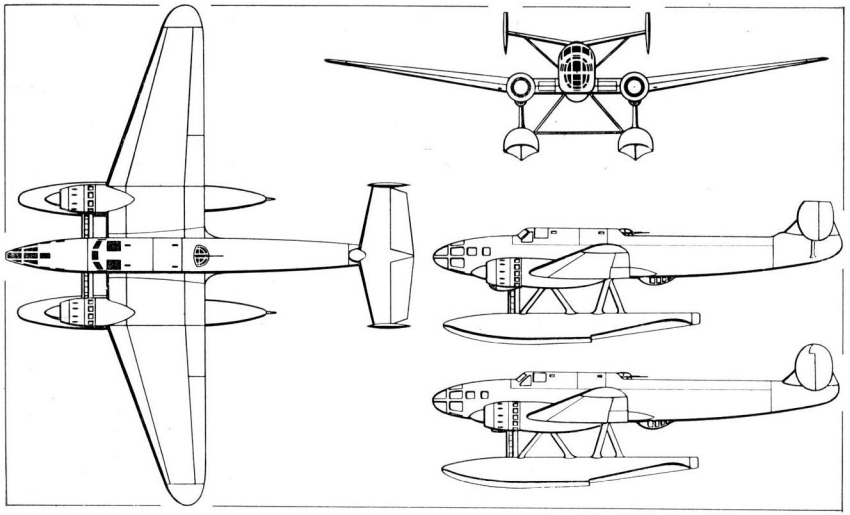
Type: *Two-seat Submarine-borne Observation Float Seaplane.* **Power Plant:** *One* 175 *h.p. Salmson 9ND nine-cylinder radial air-cooled engine.* **Performance** (*at* 2,249 *lb.*)*: Maximum speed,* 115 *m.p.h. at* 3,280 *ft.; economical cruising speed,* 81 *m.p.h.; normal range,* 215 *mls. at* 81 *m.p.h.; maximum range* (*as single-seater with auxiliary tank in second cockpit*), 404 *mls.; normal endurance,* 2 *hr.* 40 *min.* **Weights:** *Empty,* 1,521 *lb.; normal loaded,* 2,249 *lb.; maximum,* 2,513 *lb.*. **Dimensions:** *Span,* 39 *ft.* 4½ *in.; length,* 27 *ft.* 0¾ *in.; height,* 9 *ft.* 4¼ *in.; wing area,* 236.806 *sq. ft.*

In May 1937, the Ministère de l'Air ordered on behalf of the French Navy two prototypes of the MB-480 "éclaireur de combat" (torpedo-bomber-scout) floatplanes designed to meet the requirements of specification MT/CPT 9 which, first issued in 1935, had been revised and brought up to date in March 1937. The MB-480 was a very clean and shapely twin-engined low-wing monoplane bearing a strong family resemblance to the MB-131 bomber, and construction was undertaken at Marcel Bloch's plant at Courbevoie.

Of all-metal construction, the MB-480 was powered by two Gnôme-Rhône 14N fourteen-cylinder radial air-cooled engines, and provision was made for five crew members. The bomb-bay could accommodate various loads of bombs, torpedoes or auxiliary fuel tanks up to a maximum of 2,954 lb., and provision was made for a flexible 7.5-mm. Darne machine gun in the nose, a similar weapon firing from a ventral bath, and a dorsally-mounted 20-mm. Hispano-Suiza cannon on an electro-hydraulically actuated mounting. The fuel tanks with a total capacity of 374 Imp. gal. were located between the two spars in the wing centre section.

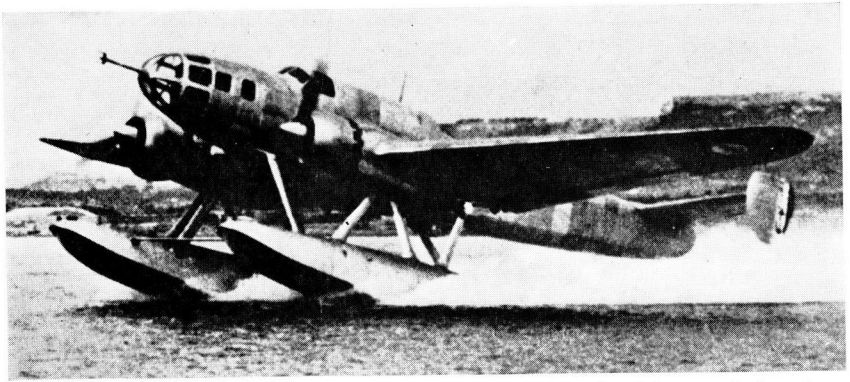
The first MB-480 prototype was transported to Marignane for final assembly, and the first flight was made during the third week of June 1939. During take-off and landing it was discovered that the tail surfaces were immersed in water spray and, in consequence, in July the complete tail assembly was raised by eleven



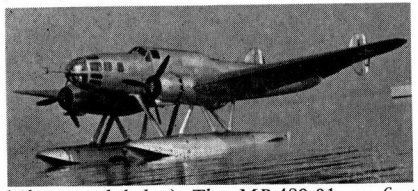


inches. In the new position the tips of the fin-and-rudder assemblies were found to obstruct the field of fire of the dorsal cannon, and as it was found that vertical surface area could be safely reduced, the tips were clipped at their second rib. At the same time, bracing struts were added to the tailplane to eliminate flutter. With these modifications, the MB-480 completed a series of trials successfully, but, in the meantime, the Admiralty had decided to introduce shore-based aircraft such as the Martin 167 and Leo 451 to perform the tasks for which the MB-480 had been conceived, and on September 9, 1939, requested the abandonment of development trials with the MB-480 so that the aircraft could be used for various other purposes. This policy was confirmed on December 10, 1939, when it was officially announced that no production orders would be placed for the floatplane.

The second MB-480 prototype was also assembled at Marignane and was flown for the first time in October 1939, and early in 1940, after trials at Saint Raphaël, the first prototype was flown to Hourtin where it received its armament. Neither prototype was used operationally, and one was destroyed when it hit a pier at Balaruc on Lake Thau during the



(*Above*) *The MB*-480-02 *with raised, braced tailplane and clipped endplate vertical surfaces.*



(*Above and below*) *The MB*-480-01 *as first flown.*

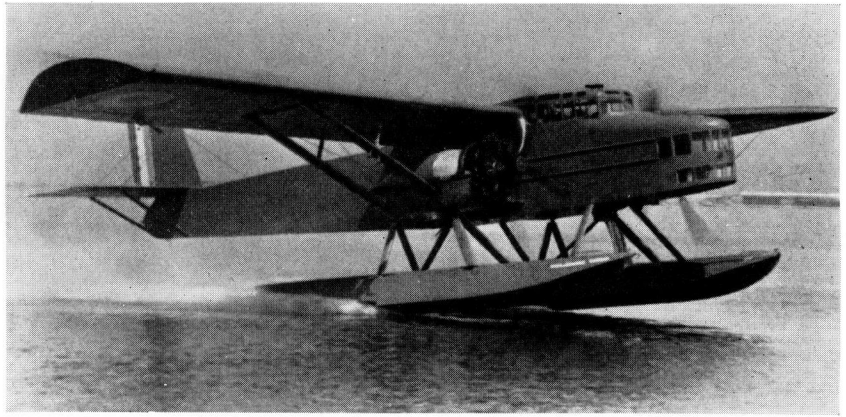
last days of June 1940. By the following month the other prototype had been placed in storage at Berre, but its subsequent fate is unknown. **Type:** *Five-seat Torpedo-Bomber and Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 1,060 *h.p. Gnôme-Rhône* 14*N* 2/3 *fourteen-cylinder radial air-cooled engines.* **Armament:** *Two flexible* 7.5-*mm. Darne machine guns and one flexible* 20-*mm. Hispano-Suiza cannon, plus five* 496-*lb. Type K bombs, three* 904-*lb. Type L bombs, or two* 1,477-*lb.* 400-*mm. Model* 1926 *DA torpedoes.* **Performance:** *Maximum speed,* 205 *m.p.h. at* 4,920 *ft.,* 196 *m.p.h. at* 5,740 *ft.; cruising speed,* 174 *m.p.h.; service ceiling,* 23,290 *ft.; range,* 1,240 *mls. at* 174 *m.p.g.* **Weights:** *Empty,* 15,476 *lb.; normal loaded,* 22,050 *lb.; maximum overload,* 26,455 *lb.* **Dimensions:** *Span,* 77 *ft.* 1⅛ *in.; length,* 62 *ft.* 8 *in.; height,* 15 *ft.* 1 *in.; wing area,* 884.792 *sq. ft.*

CENTRE NC-470 FRANCE

Aesthetically a singularly unattractive floatplane, the NC-470 began life as a private venture crew trainer on the drawing boards of the Farman company late in 1935, the project being submitted to the Section Hydraviation of the Service Technique de l'Aéronautique as the F-470 in February 1936. On March 8, 1936, the Admiralty requested that the aircraft be powered by two 480 h.p. Gnôme-Rhône 9Akx Jupiter air-cooled radial engines and that it possess an endurance of six hours. At the same time it was proposed that a production order should be placed for ten machines without floats as it was intended to equip the trainers with the spare floats that had been held in storage for the F-168 torpedo-bombers which, by that time, had been phased out of service.

In the meantime, the Farman works had been absorbed by the Société Nationale de Constructions Aéronautiques du Centre (S.N.C.A.C.), and the F-470 was redesignated NC-470, and the prototype, which was built at Billancourt and assembled at Toussus-le-Noble, flew for the first time with a temporary wheel undercarriage on December 27, 1937. During the spring of 1938, the prototype was flown to Marignane where floats were fitted and further manufacturer's trials undertaken. Official trials began during the following summer and, at the same time, final assembly of the ten production NC-470s began at

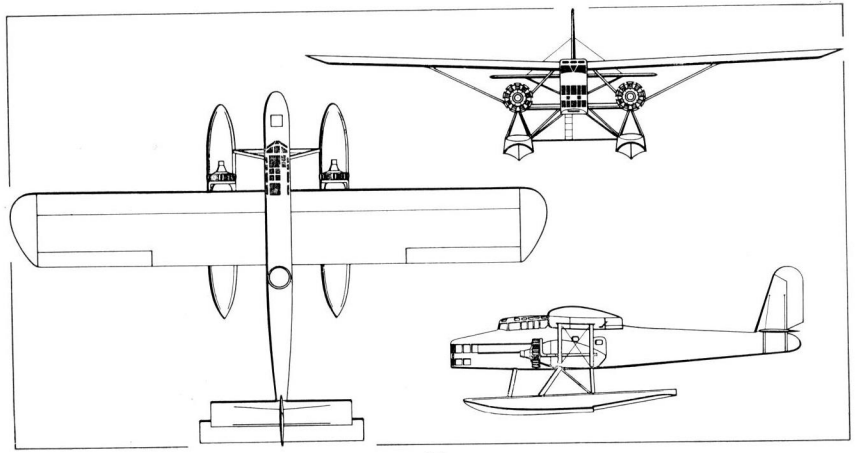
The NC-470 *crew trainer served in the coastal reconnaissance rôle early in the war.*



Toussus-le-Noble. The seventh production NC-470 was flown on January 30, 1939, and seven weeks later, on March 9, the NC-471-01 flew for the first time. Five examples of the NC-471 had been ordered by an addition to the original contract, these differing from the NC-470 solely in having 500 h.p. Gnôme-Rhône 9Kgr engines, but in the event only the prototype was completed.

The NC-470 was of mixed construction, the shoulder-mounted wing having two metal spars with wooden ribs and fabric-covering, and the fuselage having a spruce structure with stressed plywood skin. Accommodation was provided for two pilots in tandem on the port side of the fuselage, a position for a navigator-bombardier-photographer in the extreme nose, and positions for a radio-operator, flight engineer and dorsal gunner aft.

Owing to the shortage of coastal reconnaissance aircraft in the French Navy shortly before the beginning of the Second World War, late in August 1939, Escadrille 3S4 was formed with a mixture of NC-470s and C.A.M.S.55 flying boats, and by September 3, 1939, the unit possessed the sixth, seventh and eighth production NC-470s and the sole NC-471. In November of the same year, the French Navy requested permission to place orders for two additional batches of NC-470s, these calling for twenty and ten machines respectively, but no records indicate that these orders were, in fact, placed. A proposed variant was the NC-472 powered by two 600 h.p. Pratt and Whitney S3H1-G Wasp engines, but no prototype was built and, on December 17, 1939, the



French Admiralty advised the Ministère de l'Air that it had abandoned this variant.

Prior to the outbreak of war, supplementary orders for the NC-470 had evidently been placed, for by December 23, 1939, the Ecole du Personnel Volant (Non-pilot Aircrew School) at Hourtin possessed fourteen machines, and by May 2, 1940, this unit had twenty-four machines which presumably included the sole NC-471 as the strength reports for Escadrille 3S4 of May 10, 1940, list neither the NC-470 or 471. The ultimate fate of these machines is unknown, although fourteen NC-470s were seized by the Luftwaffe in November 1942.

The following specification relates to the NC-471 but is also applicable to the NC-470 apart from the engine.

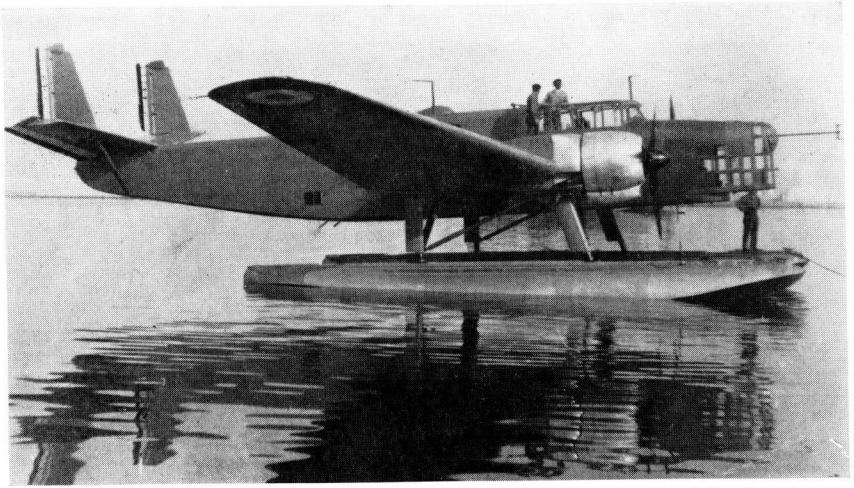
Type: *Six-seat Crew Trainer Twin-float Seaplane.* **Power Plants:** *Two* 500 *h.p. Gnôme-Rhône 9Kgr nine-cylinder radial air-cooled engines.* **Armament:** *One* 7.5-*mm. Darne machine gun in open dorsal position, four* 110-*lb. bombs and two Mle.* 1933 *flares.* **Performance:** *Maximum speed,* 143 *m.p.h.; cruising speed,* 118 *m.p.h.; climb to* 6,560 *ft.,* 9 *min.* 40 *sec.; service ceiling,* 19,685 *ft.; endurance at economical cruising speed,* 6 *hr.* **Weights:** *Empty,* 8,179 *lb.; loaded,* 13,228 *lb.* **Dimensions:** *Span,* 80 *ft.* 2½ *in.; length,* 52 *ft.* 9⅞ *in.; height,* 15 *ft.* 11 *in.; wing area,* 1,022.57 *sq. ft.*

CENTRE NC-410

FRANCE

The NC-410 twin-float torpedo-bomber-reconnaissance seaplane was first projected in 1934 as a private venture under the designation Farman F-410. Designed by engineers Roca and Caressa of Avions Henri et Maurice Farman, the F-410 had an estimated loaded weight of 21,605 lb. and was intended to carry a crew of five. After initial design studies had been completed further work was shelved until the issue of specification MT/CPT 9 on May 1, 1935. After modifications, the F-410 design was submitted for official approval early in 1936, competing with the Amiot 150, the LeO H-46 and the Loire 240. One prototype of the F-410 was ordered, this being redesignated NC-410 after the nationalisation of the Hanriot and Farman works on February 1 and March 1, 1937, respectively to form the Société Nationale de Constructions Aéronautiques du Centre.

Progress with the construction of the NC-410 prototype was extremely slow, and the aircraft was not finally assembled at Toussus-le-Noble until the summer of 1939, flying for the first time with a temporary fixed wheel undercarriage on July 10, 1939. The NC-410 followed earlier Farman designs in having extremely angular contours. The rectangular wing section which was built integral with the fuselage housed four fuel tanks with a total capacity of 616 Imp. gal., and power was provided by two 1,010 h.p. Gnôme-Rhône 14K radials driving Ratier electrically-actuated three-blade airscrews. All-metal construction was employed, and the long single-step floats were fitted with 6-in. stroke shock absorbers. The bombardier was housed in the extreme nose with a single 7.5-mm. Darne machine gun on a flexible mount, the pilot and co-pilot were seated in tandem on the port side of the fuselage, and aft of the pilots' seats was the radio operator's compartment and the dorsal gun turret. It was intended to install a semi-retractable turret housing a single 20-mm. Hispano-Suiza cannon, but this was never in fact fitted, and a



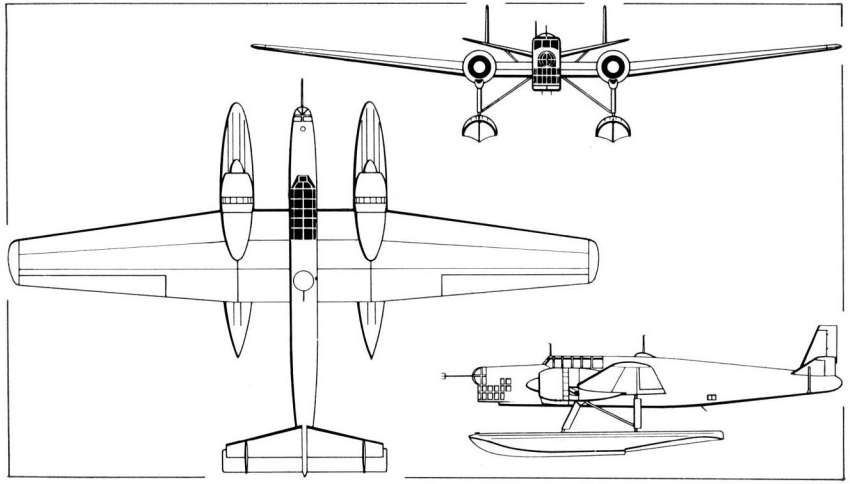
The NC-410-01 was evacuated to North Africa in June 1940, but its eventual fate is unknown.

7.5-mm. machine gun was installed in its place. A third 7.5-mm. gun was mounted in a retractable dustbin-type ventral turret. The bomb-bay in the lower part of the central fuselage was intended to house two 1,477-lb. Modèle 1926 DA torpedoes or two 330-lb. Type I bombs and jettisonable long-range fuel tanks.

Initial trials were conducted with the provisional wheel undercarriage, but the Gnôme-Rhône 14Knrs/ors engines suffered continual overheating and had to be replaced by Gnôme-Rhône 14N 2/3 engines after completing twelve flying hours. On August 22, 1939, the NC-410 was flown to Marignane where its floats were fitted, and on September 12, 1939, the aircraft flew as a floatplane for the first time from the Berre Lake. The first tests indicated promising qualities, but by this time the programme for *Hydravions Eclaireurs de Combat* was so far behind schedule that the French Admiralty which, for obvious tactical reasons, had decided to adapt the very much faster land-based LeO 451 for torpedo-dropping, requested that further development of the NC-410 and its competitors be abandoned, thus leaving the existing prototypes available for limited operational use or for test purposes.

The NC-410 was flown from Marignane to St. Raphaël on October 7, 1939, for trials at the test centre, subsequently being transferred to Biscarosse on May 18, 1940, owing to the danger of Italian raids on St. Raphaël. As the Wehrmacht approached Biscarosse the NC-410 was again evacuated, this time to North Africa. It reached Balaruc on Lake Thau on June 23, 1940, and from there was flown to Bougie, Algeria, two days later with a heavy load of naval personnel and equipment. The subsequent fate of the prototype is unknown, although it was probably disassembled and stored at Karouba.

Type: *Five-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 1,180 *h.p. Gnôme-Rhône* 14*N* 2/3 *fourteen-cylinder radial engines.* **Armament:** *One* 7.5-*mm. Darne machine gun in nose, power-operated dorsal turret and retractable ventral turret, plus two* 1,477-*lb. torpedoes, five* 496-*lb. Type K bombs or three* 904-*lb. Type L bombs.* **Performance:** *Maximum speed,* 199 *m.p.h. at* 4,920 *ft.; economical cruising speed,* 171 *m.p.h. at* 4,920 *ft.; service ceiling,* 18,050 *ft.; maximum range,* 1,243 *mls.* **Weights:** *Empty,* 18,012 *lb. loaded,* 26,411 *lb.* **Dimensions:** *Span,* 87 *ft.* 11$\frac{1}{8}$ *in.; length,* 58 *ft.* 0$\frac{7}{8}$ *in.; height,* 22 *ft.* 3$\frac{3}{4}$ *in.; wing area,* 958 *sq. ft.*

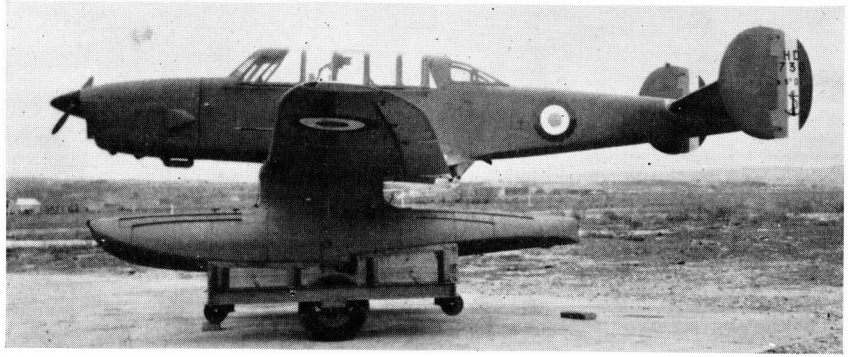


DEWOITINE HD.730-732

Designed as a catapult-launched light scout and observation aircraft to the French Navy's specification A50, the HD.730 was produced by a team led by Emile Dewoitine at the Société Constructions Aéronautiques du Midi which, in 1937, had taken over the Société Aéronautique Française Dewoitine under the Law for the Nationalisation of Military Industries. Two prototypes of the HD.730 were ordered from the Toulouse plant of the S.N.C.A.M. on March 19, 1938, and these were transported to the S.N.C.A.S.E. plant at Marignane for final assembly, the first prototype flying from the Berre Lake in February 1940.

Powered by a Renault 6Q-03 six-cylinder inline inverted air-cooled engine driving a two-bladed Ratier-1759 electric airscrew, the HD.730 was of all-metal construction, the fuselage having a stressed light alloy skin and accommodating the pilot and the observer-gunner, and the single-spar stressed-skin wing being divided into five sections; the centre section built integral with the fuselage and four folding sections, those immediately outboard of the floats folding vertically and the extreme outboard panels folding to meet above the fuselage. All movable control surfaces were fabric-covered, and the interchangeable floats were attached to the wings by cantilever pylons. All fuel was housed in two tanks in the wing centre section with a total capacity of 53 Imp. gal., a vertical camera was mounted in the rear fuselage, and defensive armament comprised one 7.5-mm. Darne machine gun with 300 rounds firing outside the airscrew arc, and a similar gun on a flexible mount for the observer.

The HD 730-01 *flew for the first time in February* 1940, *and an order for an initial batch of forty machines proposed in April* 1940 *was not placed in hand owing to the French collapse.*

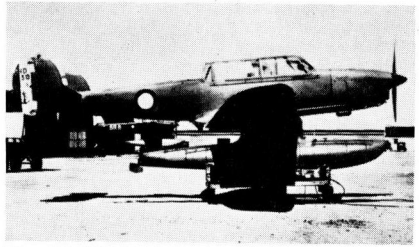


The HD.730-01 began evaluation trials at Saint Raphaël on April 26, 1940, but it was obvious that the floatplane was underpowered, and it was proposed that the Renault 6Q-03 be replaced by a Béarn 6D engine of 350 h.p. in the production model. In April 1940 it was proposed to order an initial batch of forty machines for the Navy with deliveries commencing in 1941, but in the event the order was not placed owing to France's collapse. The HD.730-02 flew for the first time from the Berre Lake in May 1940, but its transfer to Saint Raphaël was prevented by the capitulation of June 25, 1940, which grounded both prototypes, these subsequently being stored in the S.N.C.A.S.E. plant at Mazargues, in the suburbs of Marseilles.

Despite France's defeat, development of the basic design continued, and an extensively redesigned third machine, the HD.731-01, was built in Bagnères-de-Bigorre, assembled in the S.N.C.A.S.E. plant at Marignane, and flown from the Berre Lake on March 11, 1941. In order to enable the development of the aircraft to proceed, the HD.731-01 was referred to as a "hydravion colonial de liaison commerciale". Powered by the 350 h.p. Béarn 6D, the HD.731 had smaller overall dimensions than the HD.730, and the method of wing folding was revised, two folding points replacing the original four. The new wing had a span and area of 33 ft. 6 in. and 195.472 sq. ft. respectively, and the entire trailing edge was occupied by slotted flaps and ailerons. All fuel was housed in a single 53 Imp. gal. tank located in the port side of the wing centre section, aft of the main spar.

The maiden flight, with Marcel Doret at the controls, lasted forty minutes, after which some modifications were made at the Mazargues plant, including a change in the angle of the float axis from two to four degrees. Flight trials were resumed on April 22, 1941, but seven days later, after 2 hr. 20 min. had been logged in the air, tests were stopped for further modifications, the tailplane attachment points being reinforced, the elevator chord being increased by six inches, and the endplate fins and rudders being enlarged. Flight tests were once again resumed on June 30, 1941, and on July 4 measured performance revealed a maximum speed of 164 m.p.h. at 656 ft. and a cruising speed of 139 m.p.h. at the same altitude, loaded weight being 3,825 lb. This was to be the last flight of the HD.731, however, as it was decided that an increase in wing area was necessary, and as circumstances did not permit such a major modification to be made, the aircraft was disassembled and stored.

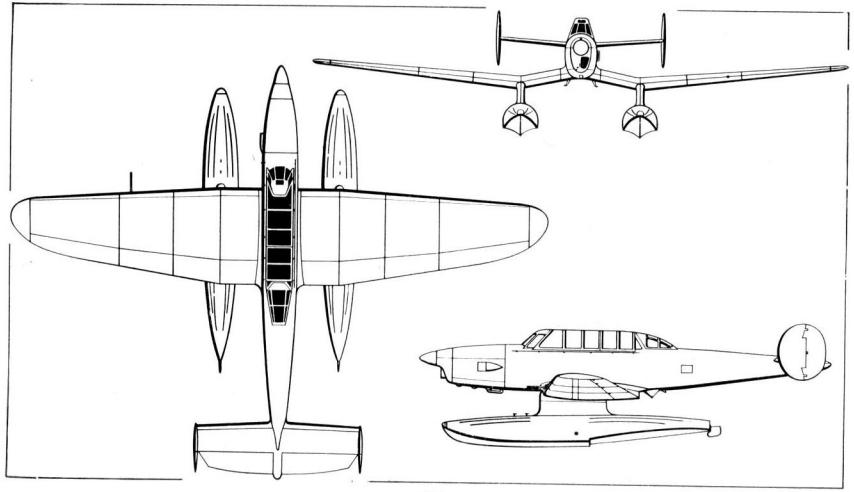
The S.N.C.A.M. had merged with the S.N.C.A.S.E. while the HD.731 had been under test, and the two prototypes of the HD.730 had been transferred from Mazargues to Marignane on June 20, 1941, for reassembly. At the same time the original 220 h.p. Renault 6Q-03 engine of the HD.730-02 was replaced by a 350 h.p. Béarn 6D. Flight trials with the HD.730-02 were resumed on September 2, 1941, with a 20-minute flight after which the tail fins were enlarged. A second flight was made on September 16, and this was followed by the introduction of a central fin with which five more flights were made between September 24 and 27. Trials were brought to a standstill

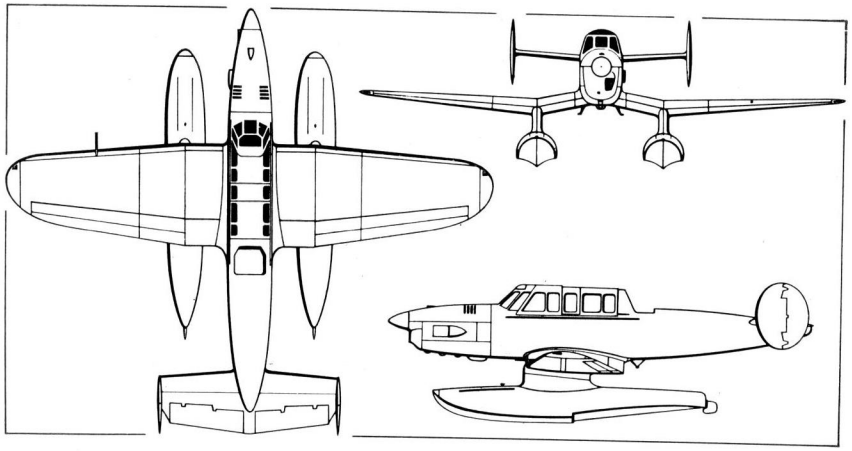


The HD.730-01 (above and illustrated by the general arrangement drawing) was eventually re-engined with a Béarn 6D power plant.

when the engine seized. While a replacement engine was awaited, the engine cowling was redesigned to improve cooling, and longer floats were fitted. The installation of a new central fin with a third rudder began on November 24, 1941, but the aircraft was not flown in this configuration as the Italian control commission forbade further trials, and the aircraft was placed in storage at the Vitrolles plant from December 18, 1941. A similar fate overtook the HD.730-01 which, by that time, had been equipped with the Béarn 6D engine.

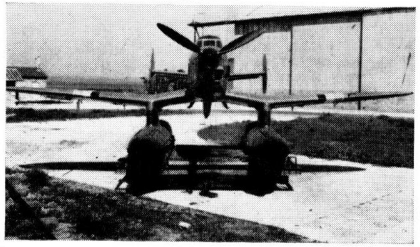
Work on the HD.730-02 was once more resumed after the withdrawal of the German forces. The triple fins were replaced by a single

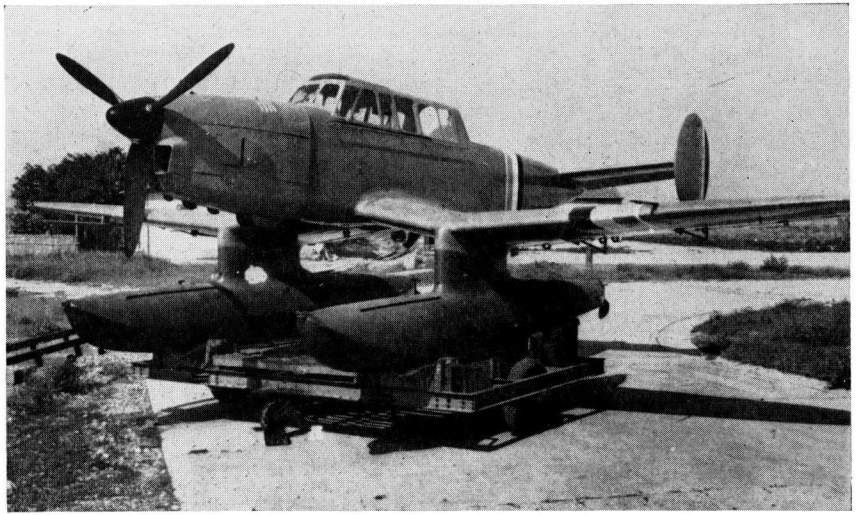




fin and rudder assembly, and Mercier ailerons were fitted to the outer wing panels to permit a greater flap span. The first flight of the HD.730-02 in its new configuration was made on July 21, 1945, after which the aircraft was transferred to the S.N.C.A.S.E. plant at Berre where the wing root fairings were enlarged and the span of the tailplane was increased by 16.9 inches. Ensuing trials indicated that all teething troubles had been successfully eradicated, and as French warships were no longer equipped with catapults, consideration was given to the possibility of producing the HD.730 as a training and communications floatplane. On June 25, 1946, the HD.730-02 was handed over for official trials, but by this time the SCAN-20 had made its début and there was no longer any interest in the HD.730.

The HD.731 (below and illustrated by the general arrangement drawing) was an extensively revised version of the basic design with smaller overall dimensions and only two wing fold points.





The HD.731-01, flown for the first time on March 11, 1941, was ostensibly a "commercial liaison" aircraft.

In this connection, it is of interest to note that a training variant of the floatplane, the HD.732, had been ordered in 1942. The prototype of the HD.732 was to have been powered by the 220 h.p. Renault 6Q and was to have had a loaded weight of 3,252 lb. In the event, this aircraft was never completed.

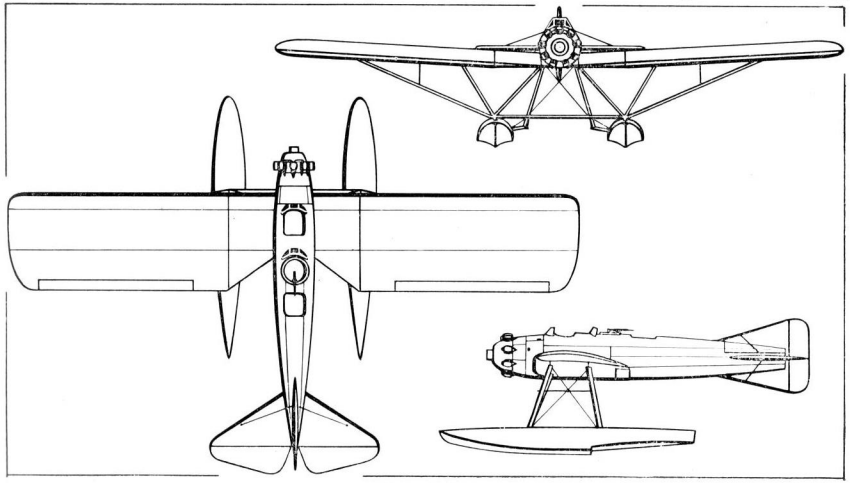
The following specification relates to the HD.730 in its original form.

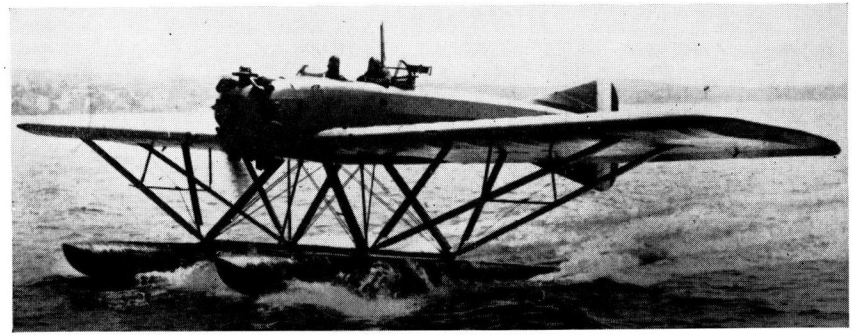
Type: *Two-seat Catapult-launched Observation-Scout Twin-Float Seaplane.* **Power Plant:** *One 220 h.p. Renault 6Q-03 six-cylinder inline inverted air-cooled engine.* **Armament:** *One fixed forward-firing 7.5-mm. Darne machine gun and one flexible 7.5-mm. Darne gun plus, eight 22-lb. bombs.* **Performance:** *Maximum speed, 143 m.p.h. at 6,560 ft.; cruising speed, 140 m.p.h. at 4,920 ft.; time to 13,780 ft., 14 min. 37 sec.; service ceiling, 16,800 ft.; range (without bombs), 840 mls., (with bombs), 435 mls.* **Weights:** *Empty, 2,586 lb.; loaded, 4,123 lb.* **Dimensions:** *Span, 41 ft. 4 in.; length, 32 ft., 0⅛ in.; height, 10 ft. 5⅛ in.; wing area, 215.278 sq. ft.*

GOURDOU-LESEURRE GL-810 - GL-812 FRANCE

Designed as a light scout-observation floatplane for operation from warships or coastal bases, the GL-810 Hy first entered service with battleships and 9,840-ton cruisers of the French Navy in 1931, and was still serving in some numbers with shore-based units at the beginning of the Second World War despite its obsolescence.

The original prototype of the GL-810 designated L 2-01 was built at the Saint-Maur works of Gourdou-Leseurre near Paris, and was flown for the first time at Sartrouville in the summer of 1926. Powered by a 380 h.p. Gnôme-Rhône Jupiter radial air-cooled engine, the L 2-01 was a two-seater of mixed construction, the fuselage being a steel-tube structure covered by light alloy panels forward and fabric aft and the wings being fabric-covered wooden structures. The soundness of the floatplane's structure was demonstrated when, during official trials at Saint Raphaël in 1927, an engine failure necessitated a forced landing in a sea of strength 6 without any damage resulting. Six pre-production aircraft were ordered under the designation L 3, these differing from the prototype in being three-seaters powered by the 420 h.p. Gnôme-Rhône Jupiter, and in having the wooden wing





The Gourdou-Leseurre L 2-01 (above) was the first prototype of the GL-810-812 series.

spars replaced by steel spars. Catapult trials were undertaken at Saint Nazaire in August 1929, and orders were placed for twenty-four production machines under the designation GL-810 Hy.

The GL-810 Hy differed from the L 3 in having the floats lengthened by 27.5 inches. The airframes were manufactured at Saint-Maur and the floats were produced at Les Mureaux where the aircraft were assembled. Twenty additional GL-810s were ordered on September 2, 1931, seventeen more aircraft being added to this contract on March 31, 1932. A week later, ten more aircraft were ordered, and a final contract calling for fifteen machines was placed on October 5, 1933, to bring total production to eighty-six machines. Some of these were designated GL-811, this version differing from the standard GL-810 in having folding wings, and the final machines were designated GL-812, these having the folding outboard wing panels staggered by four inches.

In July 1931, Escadrille 7S2 was formed with GL-810s aboard the seaplane carrier *Commandant Teste*, and when the 7,580-ton cruisers of *La Galissonnière* type and the battleships *Dunkerque* and *Strasbourg* were commissioned from 1935 onwards they were equipped with floatplanes of the GL-810 series. On September 1, 1935, the fifth production GL-810 was sent to the Centre d'Etudes de Toulon for conversion as a target drone. After extensive trials with this aircraft, the workshops of the Saint Mandrier Naval Air Station were instructed to convert a further five GL-810s as drones, and from September 1937, a number of machines were equipped as target tugs.

By the beginning of the Second World War, the GL-810 series floatplanes had been supplanted by later types aboard French warships, the old machines being handed over to shore-based units, and new units had been formed in

August 1939 which included GL-810 series aircraft on their strengths. By September 20, 1939, Escadrilles 2S1 and 2S4 were operating GL-810s mixed with C.A.M.S. 55s and C.A.M.S. 37s respectively, 3S1 had eight GL-810 series floatplanes, 3S3 had six, 3S6 had three together with Levasseur P.L.15s, and 8S2 had four. Initially, the GL-810s with the shore-based Escadrilles de Surveillance were used to patrol coastal waters, but they were progressively replaced by such types as the Loire 130. On May 10, 1940, Escadrille 1S2 had six GL-810 series floatplanes and three Laté 29.0s, and Escadrille 3S3 possessed nine GL-810s. During the retreat from Lorient to Hourtin, 1S2's Gourdou-Leseurres were overloaded, carrying at least four men in addition to freight and equipment, but they were all captured by German forces at Hourtin late in June 1940. Escadrille 3S3 began conversion to the Loire 130 on June 18, 1940, and on July 14, 1943, Escadrille 17S still possessed two GL-810 series aircraft at Martinique.

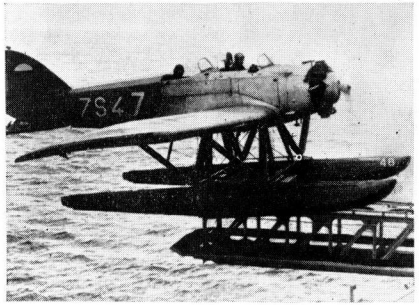
Type: *Three-seat Observation and Scout Twin-float Seaplane.* **Power Plant:** *One* 420 *h.p. Gnôme-Rhône 9Ady Jupiter nine-cylinder radial air-cooled engine.* **Armament:** *One fixed-forward-firing 7.7-mm. Vickers machine gun and two 7.7-mm. Lewis guns on flexible mount, plus two 165-lb. G2 bombs.* **Performance:** *Maximum speed,* 112 *m.p.h. at sea level; cruising speed,* 98 *m.p.h. at* 3,280 *ft.; climb to* 9,840 *ft.,* 16 *min.; service ceiling,* 18,045 *ft.; range,* 348 *mls. at* 87 *m.p.h.* **Weight:** *Empty,* 3,682 *lb.; loaded,* 5,423 *lb.* **Dimensions:** *Span,* 52 *ft.* 6 *in.; length,* 34 *ft.* 5 *in.; height,* 13 *ft.* 11¾ *in.; wing area,* 462.848 *sq. ft.*

GOURDOU-LESEURRE GL-832 HY — FRANCE

Together with the earlier GL-810 and the Potez 452, the GL-832 Hy two-seat light observation-scout monoplane was standard catapult equipment aboard French cruisers in the mid 'thirties, and was also carried by tropical sloops, being lowered to the water and retrieved by crane. The prototype, the GL-831-01 powered by a 250 h.p. Hispano-Suiza 9Qa nine-cylinder radial air-cooled engine, was delivered to Saint Raphaël on January 25, 1932, for official evaluation trials. These trials were interrupted in May of that year for various modifications, including the redesign of the float rudders and the tail assembly, being resumed in July, and in 1933 an initial batch of six production aircraft was ordered, these being designated GL-832 Hy and powered by the 230 h.p. Hispano-Suiza 9Qb, a de-rated version of the 9Qa.

The Gourdou-Leseurre company requested authority to install the fully rated Hispano-Suiza 9Qd engine, but the French Navy did not consider that it was worthwhile to increase the power of the aircraft which was intended to operate far outside the range of enemy shore-based machines, and the Hispano-Suiza 9Qb was retained for subsequent production GL-832s. A total of approximately thirty GL-832s was built, these being of metal construction with fabric covering, apart from the forward fuselage which was covered by light alloy panels.

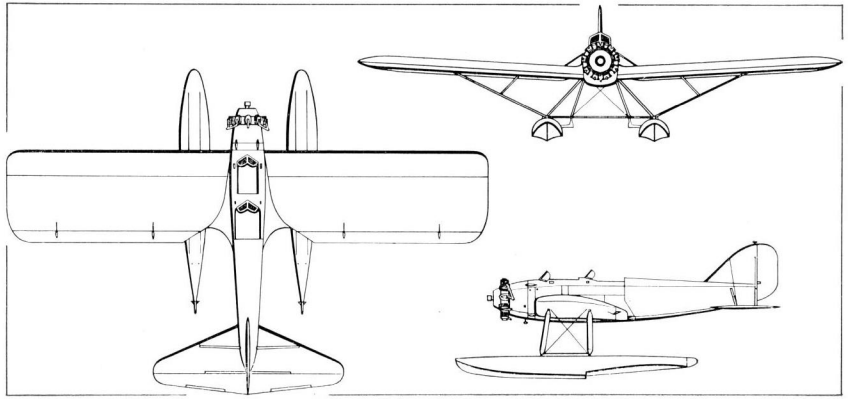
With the exception of the *Emile Bertin, Duguay Trouin, Lamotte-Picquet,* and *Primauguet,* all cruisers had been re-equipped with heavier aircraft than the GL-832 Hy by the end of 1938, and in September 1939, the Far East Fleet possessed five GL-832s of which two were aboard the *Primauguet,* two were aboard tropical sloops and one was held in reserve at



The GL-832 Hy, the fifteenth production example of which is illustrated above, was standard catapult equipment aboard French cruisers in the mid 'thirties.

Saigon. At the same time, the *Emile Bertin* and two independent tropical sloops had a further five GL-832s, and on August 15, 1940, the French Navy still had eight floatplanes of this type on first-line strength.

Type: *Two-seat Catapult-launched Observation and Scout Twin-float Seaplane.* **Power Plant:** *One* 230 *h.p. Hispano-Suiza* 9*Qb nine-cylinder radial air-cooled engine.* **Armament:** *One flexible* 0.303-*in. Lewis machine gun.* **Performance:** *Maximum speed,* 117 *m.p.h. at* 3,280 *ft.,* 121 *m.p.h. at* 6,560 *ft.,* 114 *m.p.h. at* 9,840 *ft.; time to* 3,280 *ft.,* 5 *min.* 40 *sec., to* 9,840 *ft.,* 17 *min.* 30 *sec.; service ceiling,* 15,750 *ft.; range,* 348 *mls.* **Weights:** *Empty,* 2,443 *lb.; normal loaded,* 3,743 *lb.; maximum,* 3,858 *lb.* **Dimensions:** *Span,* 42 *ft.* 7¾ *in.; length,* 28 *ft.* 7¾ *in.; height,* 9 *ft.* 1½ *in.; wing area,* 322.917 *sq. ft.*

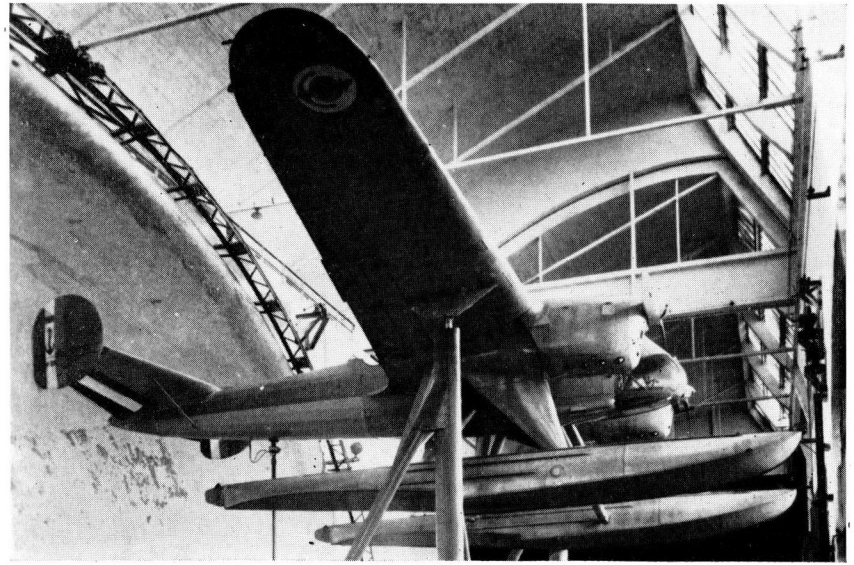


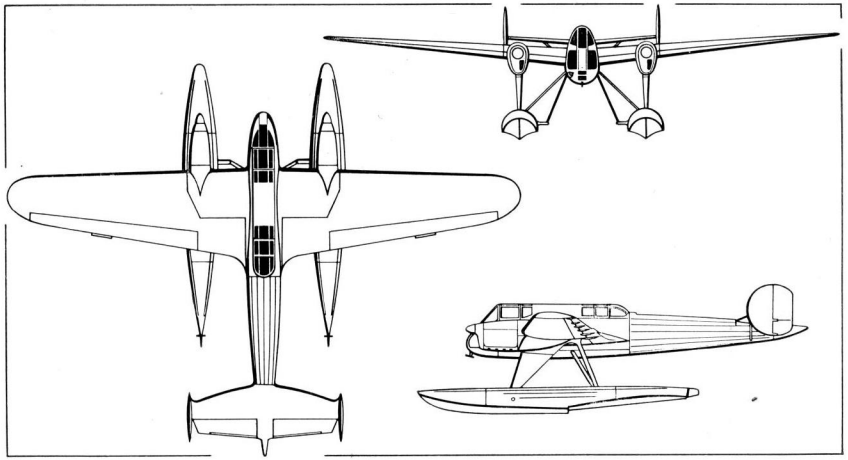
GOURDOU G-120 HY

FRANCE

During 1937 the French Navy prepared a specification for a catapult-launched two-seat observation-scout monoplane to replace the Potez 452 and the Gourdou-Leseurre GL-832. Loaded weight was not to exceed 3,530 lb., and the aircraft had to be capable of the secondary roles of convoy escort and attacks on ground targets in limited operations. To meet the requirements of the specification, M. Bruner of the Gourdou company (Gourdou and Leseurre having separated earlier in the year) began the design of the G-120 shortly before the end of 1937, and the prototype was completed at the Gourdou plant at Saint Maur, near Paris, in December 1939.

Powered by two 140 h.p. Renault 4P-O1 four-cylinder inverted air-cooled engines driving two-bladed fixed-pitch airscrews, the





G-120 Hy had a light alloy wing covered by fabric, the leading edge being reinforced with plywood. The centre section was a torsion box to which were attached the fuel tanks, and immediately outboard of the engine nacelles the wings were arranged to fold. The Gourdou-Bruner electrically-operated flaps spanned the entire wing trailing edge. The fuselage was a welded chrome-molybdenum steel-tube structure covered by detachable light metal panels to the radio-operator/gunner's position with fabric aft.

After an extensive series of tests in the Chalais-Meudon wind tunnel, the G-120 Hy was transported to Athis-Mons where it made its first flight on June 2, 1940, taking-off from the Seine. Some minor adjustments to the flaps had just been completed when German forces entered Paris but, despite being fully airworthy, the G-120 Hy was not flown to safety, being scuttled in the Seine.

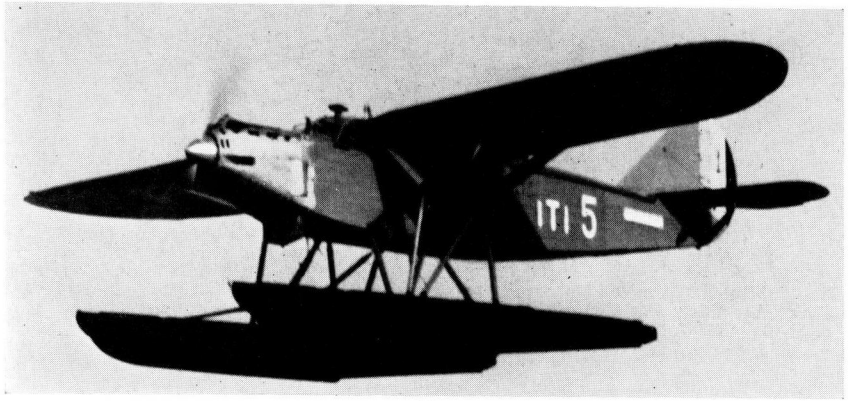
Type: *Two-seat Catapult Observation-Scout Twin-float Seaplane.* **Power Plants:** *Two* 140 *h.p. Renault* 4P–01 *four-cylinder inline inverted air-cooled engines.* **Armament:** *One fixed forward-firing* 7.5-*mm. Darne machine gun and one flexible* 7.5-*mm. Darne gun, plus eight* 22-*lb. bombs.* **Performance:** *Maximum speed,* 149 *m.p.h. at sea level; economical cruising speed,* 93 *m.p.h. at* 3,280 *ft.; range,* 233 *mls. at* 3,280 *ft.; normal endurance,* 2 *hr.* 30 *min.* **Weights:** *Loaded,* 3,527 *lb.* **Dimensions:** *Span,* 39 *ft.* 4½ *in.; length,* 29 *ft.* 11⅞ *in.; height,* 10 *ft.* 0½ *in.; wing area, sq.ft.* 198.055.

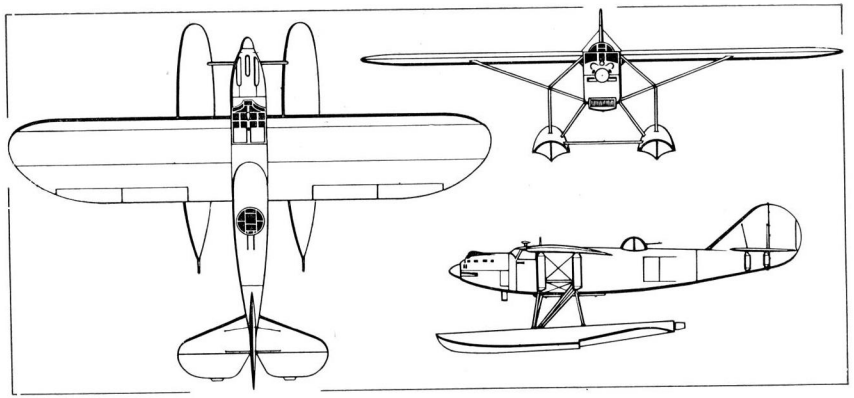
LATÉCOÈRE 29.0 FRANCE

During the 'twenties, the Société Industriéllé d'Aviation Latécoère evolved a series of commercial monoplanes culminating in the Laté 28, and in 1930 the company began the development of a torpedo-carrying aircraft rom the Laté 28.3 mail-carrying and Laté 28.5 record-breaking floatplanes. Designated Laté 29.0 the torpedo floatplane was structurally similar to its civil progenitors, the wing being a fabric-covered two-spar structure braced to the fuselage by two pairs of parallel sloping metal struts, and the fuselage being a steel-tube structure with light alloy skinning forward and fabric covering aft. Power was provided by a 650 h.p. Hispano-Suiza 12 Nbr liquid-cooled engine, and three crew members were carried, the pilot being seated on the port side of the fuselage with a 176 Imp. gal. fuel tank immediately aft, the radio operator-navigator being accommodated aft of the fuel compartment, and the gunner having a manually-operated dorsal turret housing twin Lewis guns.

The prototype, the Laté 29.0-01, was built at Toulouse-Montaudran where it flew for the first time as a landplane early in 1931. After preliminary trials, the prototype was flown to St. Laurent-de-la-Salanque where it was fitted with twin single-step floats and tested from Lake Leucate, subsequently being delivered to Saint Raphaël for official trials which began on October 21, 1931, and were completed on December 9. These trials resulted in the placing of an order for twenty Laté 29.0

A Laté 29.0 *of Escadrille* 1T1 *which was formed in* 1935. *The Laté* 29.0 *remained operational until the French capitulation, patrolling the channel coast from Cherbourg.*





torpedo floatplanes in the spring of 1932, these being intended to operate from coastal bases, and the second prototype, the Laté 29.0-02 began tests at Saint Raphaël on October 18, 1932.

The first production Laté 29.0s were completed before the end of 1932 and were delivered to the newly-formed Escadrille 4T1 based on Lake Berre. Like the prototypes, the production machines were completed as landplanes at Toulouse-Montaudran and flown to St. Laurent-de-la-Salanque to be equipped with floats, and an additional production order was placed on October 5, 1933. In July 1934, one Laté 29.0 was used to test the first electrically-operated variable-pitch Ratier airscrews, and another was used to test stainless-steel floats in the following November.

In 1935, Escadrille 1T1 came into existence with a strength of nine Laté 29.0s, and the Sections d'Entrainement at Berre and Cherbourg each possessed one Laté 29.0. During the year both Laté 29.0-equipped Escadrilles undertook successful dive-bombing trials with their aircraft, and on October 1, 1938, Escadrilles 4T1 and 1T1 were redesignated T1 and T2 respectively, both converting to the Laté 298 shortly afterwards, their earlier torpedo floatplanes being passed to training units or placed in storage. Four of these were issued to Escadrille 1S2 which was formed at Cherbourg late in August 1939, this unit also having some Gourdou-Leseurre GL-812s, and the Laté 29.0s patrolled the channel coasts for some nine months until Escadrille 1S2 retreated along the Atlantic coast in front of the advancing German forces. Immediately before being ordered South, the Laté 29.0s actually undertook dive-bombing missions against enemy surface vessels, and on June 25, 1940, the floatplanes were immobilised on Lake Hourtin in the zone occupied by the Wehrmacht.

Several experimental variants of the Laté 29.0 were built and flown, these including the Laté 29.3 flown in 1932 with an 800 h.p. Gnôme-Rhône 14Krs radial air-cooled engine; the Laté 29.4 with an 830 h.p. Gnôme-Rhône 14Kdrs, redesigned rear fuselage to improve the dorsal gunner's field of fire, and modified inboard wing leading edges to improve pilot vision which was flown in 1934, and the Laté 29.6 which was generally similar to the Laté 29.4 apart from having an 840 h.p. Hispano-Suiza 12 Ycrs liquid-cooled engine.

Although no exact figure for Laté 29.0 production is now available, it is believed that approximately thirty-five machines were built.

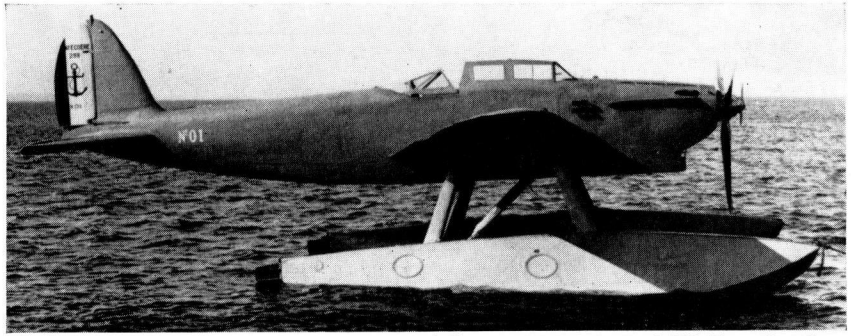
Type: *Three-seat Torpedo Twin-float Seaplane.* **Power Plant:** *One* 650 *h.p. Hispano-Suiza* 12 *Nbr twelve-cylinder Vee liquid-cooled engine.* **Armament:** *One fixed forward-firing* 7.7-*mm. Vickers machine gun and two* 7.7-*mm. Lewis guns in dorsal turret, plus one* 400-*mm. Type* 1926 *DA torpedo or two* 330-*lb. bombs.* **Performance:** *Maximum speed,* 131 *m.p.h. at sea level; economical cruising speed,* 94 *m.p.h.; climb to* 4,920 *ft.,* 7 *min.* 37 *sec.; service ceiling,* 13,450 *ft.; range,* 435 *mls. at* 99 *m.p.h.* **Weights:** *Empty,* 6,596 *lb.; loaded,* 10,582 *lb.* **Dimensions:** *Span,* 63 *ft.* 1¾ *in.; length,* 47 *ft.* 6 *in.; height,* 18 *ft.* 2½ *in.; wing area,* 626.458 *sq. ft.*

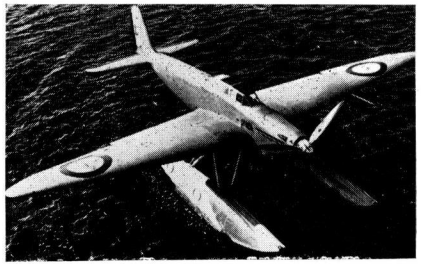
LATÉCOÈRE 298 — FRANCE

Characterised by extreme sturdiness of structure and exceptional manoeuvrability, features destined to stand it in good stead during the German offensive against France of May 1940, the Laté 298 was designed in 1934 at the Toulouse-Montaudran plant of Latécoère to meet requirements framed by the French Navy in the previous year for a torpedo floatplane of advanced performance to succeed the Laté 29.0 which had just entered service. The prototype, the Laté 298-01, was completed in the spring of 1936, and transported to Saint-Laurent-de-la-Salanque for trials from the Leucate Lake from where it flew for the first time on May 8.

A mid-wing cantilever monoplane powered by an 880 h.p. Hispano-Suiza 12Ycrs1 twelve-cylinder Vee liquid-cooled engine, the Laté 298-01 had a two-spar all-metal wing built in four sections, the entire trailing edges of which were hinged, the inner portions acting as camber-changing flaps and the outer portions as ailerons. The stub inner portions of the wings which attached to the fuselage frames housed semi-retractable radiators between the spars. The fuselage was an all-metal stressed-skin structure of rectangular section providing accommodation for either two or three crew members, and a single 1,477-lb. Type 1926 DA torpedo was accommodated semi-externally by a ventral crutch. The tailplane was of all-metal construction and the vertical surfaces had metal frames and wooden ribs covered by fabric. The exceptionally large single-step floats each housed a 57 Imp. gal. fuel tank and were attached by N-struts to the wings and by parallel sloping struts to the fuselage.

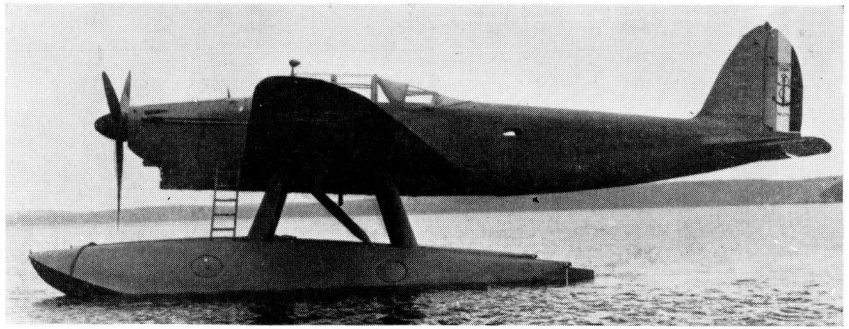
Manufacturers' trials were completed on September 24, 1936, after 24 hours and 35 minutes had been logged in the air, and during these trials a spreader bar had been added between the floats, this being retained for subsequent production machines. On September 25 the Laté 298-01 was flown to Saint Raphaël for official trials, and on March 17,





(Above and left) The Laté 298-01 *as first flown in May* 1936 *and before the addition of a spreader bar between the floats.*

1937, the Navy requested thirty-six Laté 298 floatplanes of which twelve were to be fitted with folding wing outer panels for operation from the *Commandant Teste*. Accordingly, on August 10, 1937, contracts were placed for twenty-four Laté 298A floatplanes with fixed wings and twelve Laté 298Bs with folding wing outer panels, folding tailplane tips, two-piece flaps, and dual controls. The Laté 298B also provided accommodation for four crew members, an observer's station having been inserted in the fuselage aft of the gunner's station. Both variants had the TGPU/CEPA crutch-type torpedo housing which could accommodate a 117.5 Imp. gal. auxiliary fuel tank for the so-called Mission III (reconnaissance with 1,367-mile range) or a smoke-screen housing for Mission V (shipping protection), and could be supplanted by two GPU racks for 330-lb. bombs for Mission II (bombardment) or by nine racks for flares for Mission IV (night observation). The Laté 298A floatplanes were production aircraft Nos. 1 to 24 inclusive, Laté 298B production commencing with aircraft No. 25. On April 2, 1938, a further contract was signed for fifteen Laté 298Bs (Nos. 37 to 51) and five Laté 298Ds (Nos. 52 to 56), the latter being similar to the B-model apart from having the wing folding equipment eliminated, the designation Laté 298C being applied to a version of the float-



The twenty-fourth and last production Laté 298*A. Ordered on August* 10, 1937, *the Laté* 298*A first entered service with Escadrille T*2.

plane which was not proceeded with.

On June 22, 1938, the Laté 298-01 was flown for the first time with an electrically-actuated Ratier constant-speed airscrew similar to that selected for the production models which were being assembled at Biscarosse, the fuselages and floats having been built at Montaudran and the wings and tail assemblies at Anglet, near Bayonne. The Laté 298-01 was used for conversion training from October 28, 1938, at Saint Raphaël to where the pilots of Escadrille T2 had been temporarily posted, these being joined by personnel from Escadrille T1 early in the following month. In the meantime, on October 29, 1938, the first production Laté 298A had flown at Biscarosse, deliveries of the floatplane to Escadrilles T1 and T2 commencing during the following December. Early in 1939, Escadrille HB1 based aboard the seaplane carrier *Commandant Teste* also received the Laté 298A pending the availability

of the folding-wing Laté 298B. The Laté 298A was essentially similar to the Laté 298-01 apart from a redesigned cockpit enclosure providing improved vision for the crew members.

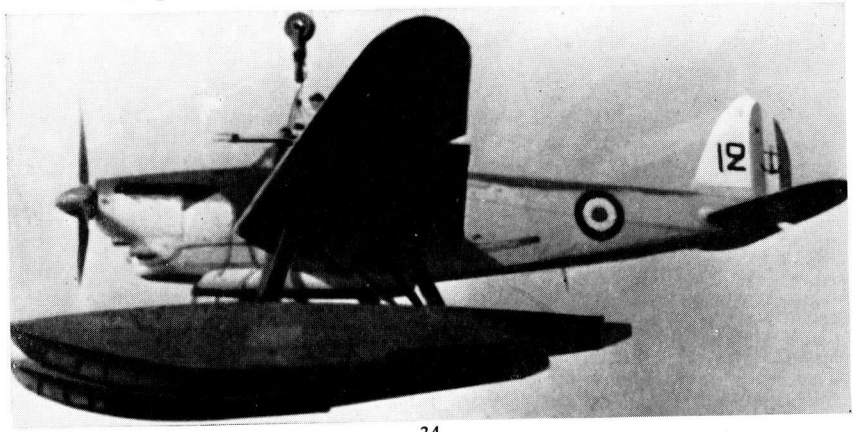
A further batch of twenty-five Laté 298D floatplanes (Nos. 57 to 81) was ordered on April 5, 1939, but as the output of Ratier airscrews was not keeping pace with airframe delivery, on August 29, 1939, it was decided to temporarily fit the Chauvière 5427 fixed-pitch two-blade wooden airscrew. This airscrew necessitated a reduction in normal loaded weight from 10,141 lb. to 9,700 lb., and called for a 121.5-lb. ballast weight attached to the second frame of each float.

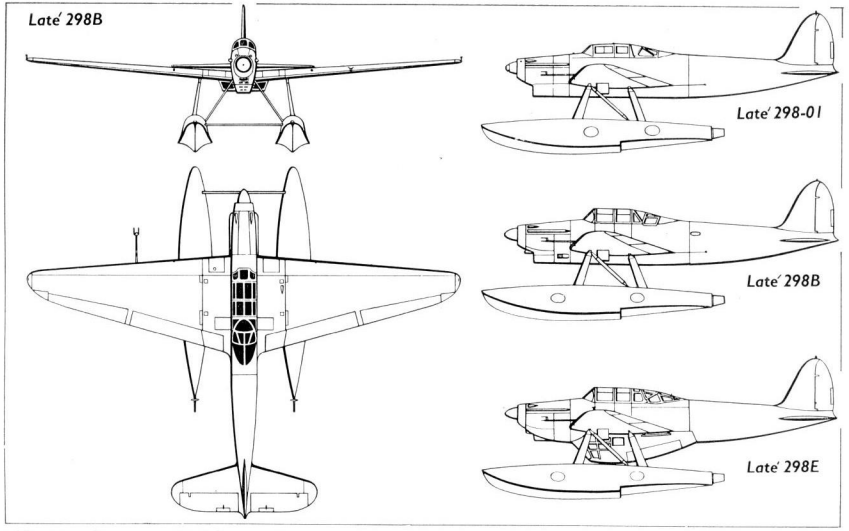
At the beginning of the Second World War, the French Navy possessed four Laté 298-equipped Escadrilles, T1 at Berre, T2 at Cherbourg, and HB1 and HB2 aboard the *Commandant Teste*. Escadrille T3 was formed on the Laté 298 on September 15, 1939, and by the following month, fifty-three floatplanes of this type were serving with the Navy, and twenty-eight had still to be delivered. A further sixty-five Laté 298s were ordered on November 22, 1939, and on January 9, 1940, the sixty-eighth production machine (a Laté 298D) was accepted at Biscarosse, Escadrille T4 being formed on the 15th of that month to operate the Latécoère.

On March 10, 1940, the eighty-first production machine was handed back to the manufacturers by the Navy for conversion as an observation machine under the designation Laté 298E. The cockpit enclosure was extended and the torpedo crutch removed and replaced by an observer's gondola. The Laté 298E was intended for the dual role of observation and coastal patrol, and for the latter task carried the standard defensive armament of three 7.5-mm. Darne machine guns, and two 165-lb. G2 bombs could be carried over a range of 963 miles.

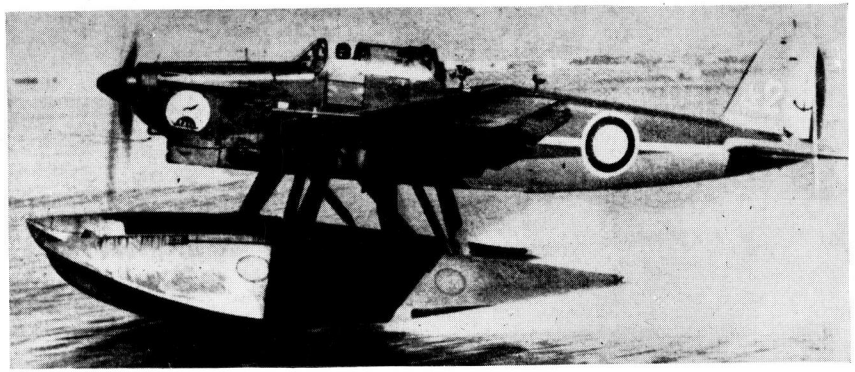
On May 10, 1940, when the German offensive began, the five Laté 298 units each had a strength of ten aircraft. T1, T2 and T3 were based at Cherbourg and Boulogne-sur-Mer, while T4, HB1 and HB2 were based on the Mediterranean coast (the last two mentioned Escadrilles were shore-based as the *Commandant Teste* had been relegated to the transport role). Initially, the Boulogne-based Laté 298s flew coastal patrols to cover the

A late production Laté 298D with deeper bomb-bay and bomb-bay doors.





Allied landings on Walcheren, but the absence of German warships and the shortage of Armée de l'Air attack aircraft dictated the use of the floatplanes against the advancing German columns. The Laté 298s evacuated Boulogne on May 21, 1940, but continued operating in the dive-bombing and ground strafing roles from Cherbourg. An example of the activities of the Laté 298-equipped units at this time is provided by a sortie undertaken on May 23 when eighteen of these floatplanes dive-bombed with 1,100-pounders bridges and road junctions between Boulogne and the River Somme, losing three aircraft to Bf 109E fighters and one to ground fire. Had it not been for the exceptional structural sturdiness and manoeuvrability of the Laté 298 losses would undoubtedly have been very much greater. However, night sorties were considered more prudent, and the Laté 298 was subsequently employed largely in the night attack role, and among many targets attacked during nocturnal sorties was the Noyelles bridge over the Somme which was bombed by Escadrille T3 on the night of June 10. During the retreat from Cherbourg to Hourtin and Berre both attack sorties and anti-submarine patrols were flown by the Laté 298s. Genoa



A Laté 298D of Escadrille 4T of the 6e Flottille of the Vichy Navy.

was bombed several times by Laté 298s based at Berre, and Escadrille HB1 based on the Oubeira Lake, Tunisia, attacked Italian cruisers. On May 23, Escadrille 1S1 had begun conversion to the Laté 298, and by mid-June Escadrille 3S6 based at Aspretto, Corsica, had also begun conversion, but the capitulation prevented the re-equipment of any additional units.

On August 1, 1940, the Laté 298-equipped Escadrilles T1, T2, T3, T4, HB1, HB2, 1S1 and 3S6 were redesignated 1T, 2T, 3T, 4T, 1HT, 2HT, 1S and 12S respectively, and on the 15th of that month the French Navy possessed seventy-five Laté 298s. Escadrilles 1S, 1HT, 2HT and 12S were disbanded and two new torpedo floatplane units, Escadrilles 5T and 6T, were formed at Berre by the Vichy government and flown to Dakar in July and August 1941. Production of the floatplane was resumed in March 1942 with the authorisation of the German Armistice Commission, thirty Laté 298Fs being ordered, these being identical to the Laté 298D apart from some simplification of the controls. After November 1942, every attempt was made on the part of the personnel of the Berre factory to slow down deliveries of the Laté 298 so that the Luftwaffe, which had captured the floatplanes of the 6e Flottille (Escadrilles 3T and 4T) during the occupation of Vichy France, would never have sufficient aircraft to equip an operational Staffel.

On November 7, 1942, the Laté 298-equipped units of the Vichy Navy had comprised the 5e Flottille (Escadrilles 1T and 2T) based at Arzew, the 6e Flottille (Escadrilles 3T and 4T) based at Berre, and the 7e Flottille (Escadrilles 5T and 6T) based at Dakar, each Flottille having a statutory strength of thirteen

aircraft. The 6e Flottille was disbanded on November 27, 1942, and, as already recounted, its equipment captured by the Luftwaffe, and the 5e Flottille was shortly afterwards disbanded and reformed as Escadrille 4S1, patrolling the Western Mediterranean from Arzew, a task which it continued to undertake after being redesignated Escadrille 2S in the summer of 1943. The 7e Flottille was similarly engaged in patrolling West African coastal waters with its Laté 298s and was disbanded on March 12, 1943, and reformed as Escadrille 1S. This unit operated both Laté 298s and Loire 130 flying boats until disbanded at Dakar on November 1, 1943, its surviving Laté 298s being transferred to Escadrille 2S at Arzew which, on April 1, 1944, possessed sixteen Laté 298s.

By this time, Escadrille 2S was operating with R.A.F. Coastal Command, co-operating with Wellingtons which acted as submarine hunters, the Laté 298s serving as the killers. In November 1944, Escadrille 2S was transferred to Saint Mandrier to patrol France's southern coastline, its equipment being reinforced by a half-dozen Laté 298s discovered in Luftwaffe markings afloat at Berre. Four other machines (Nos. 41, 49, 81 and 126) were discovered in storage at Berre, and a second Laté 298 unit was therefore formed, Escadrille 3S which came into existence at Saint Mandrier on April 1, 1945. From April 10 four Laté 298s of Escadrille 2S were based at Hourtin to patrol the waters off the German strongholds on the French Atlantic coast, and scored a number of successes against German armed trawlers, forcing two of these to enter French-occupied harbours and surrender. From January 1943 to VE-day, the Laté 298s of Escadrille 2S alone logged 5,363 operational flying hours during 2,038 sorties. Escadrille 3S was transferred to Immenstadt, near Friedrichshafen on May 15, 1945, using its Laté 298s for policing patrols until the unit was disbanded on February 1, 1946. Escadrille 2S was disbanded two months later, and all the surviving Laté 298s of both units were transferred to Escadrille 53S (Ecole des Pilotes d'Hydravions) at Hourtin where all but three were finally scrapped in 1950. Of the three, two were handed over to the Aéronavale technical school at Rochefort and one was maintained in flying condition, the last-mentioned machine being statically displayed during the 1951 Salon Nautique after having alighted on the Seine at Suresnes. A development of the Laté 298, the Laté 299 with a retractable wheel undercarriage and intended for operation from aircraft carriers, will be described in the appropriate volume.

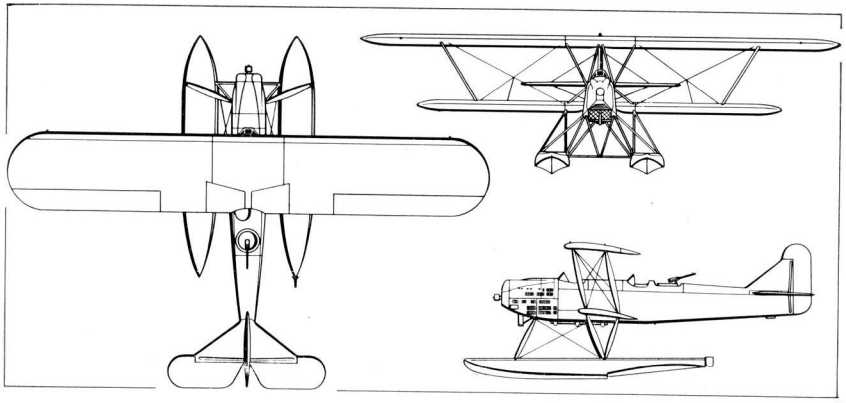
The following specification relates to the Laté 298D.

Type: *Two/three-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 880 *h.p. Hispano-Suiza* 12*Ycrs*1 *twelve-cylinder Vee liquid-cooled engine.* **Armament:** *Two fixed forward-firing wing-mounted* 7.5-*mm. Darne machine guns with* 300 *r.p.g. and one* 7.5-*mm. Darne gun on a flexible mount with* 500 *rounds, plus one* 1,477-*lb. Type* 1926 *DA torpedo or one* 1,100-*lb. bomb, or two* 330-*lb. Type* 12 *or* 165-*lb. Type G2 bombs, three depth charges, or nine Type* 1933 *flares.* **Performance:** *Maximum speed,* 180 *m.p.h. at* 6,560 *ft.; cruising speed,* 152 *m.p.h. at* 6,560 *ft.; climb to* 4,920 *ft.,* 5 *min.* 39 *sec.; service ceiling,* 21,325 *ft.; range (with torpedo),* 497 *mls.; maximum range (reconnaissance),* 1,367 *mls.* **Weights:** *Empty,* 6,750 *lb.; loaded (torpedo-bomber),* 10,141 *lb., (reconnaissance),* 10,582 *lb.* **Dimensions:** *Span,* 50 *ft.* 10¼ *in.; length,* 41 *ft.* 2½ *in.; height,* 17 *ft.* 1¼ *in.; wing area,* 340.139 *sq. ft.*

LEVASSEUR P.L.15 FRANCE

Derived from the P.L.14, the P.L.15 torpedo-bomber floatplane was ordered by the Ministère de l'Air on behalf of the Aéronautique Maritime late in 1931 when the Etablissements P. Levasseur was awarded a production contract for sixteen machines. Of fabric-covered mixed construction, the P.L.15 carried two crew members for the torpedo-bomber role, but three were carried for observation missions, and provision was made for four crew members for the reconnaissance role. The first P.L.15s were assembled and test-flown as landplanes at Villacoublay in October 1932, and were then flown to Les Mureaux to be fitted with their floats. The first production machine completed its acceptance trials as a floatplane at full loaded weight at Les Mureaux in April 1933, and this aircraft subsequently completed fifty hours of trials at Saint Raphaël before being delivered to the

*The Levasseur P.L.*15 *was one of the oldest floatplanes to be used operationally in* 1939.



St. Mandrier Naval Air Station late in 1933.

In June 1934, the Escadrille 7B2 aboard the seaplane carrier *Commandante Teste* had received three P.L.15s, this unit eventually being redesignated HB1 on October 1, 1938, and re-equipping with the Laté 298 early in 1939. The P.L.15s with which the unit had been previously equipped were then handed over to the Sections d'Entrainement or placed in storage, but on September 20, 1939, the newly-formed Escadrille 3S6 had five P.L.15s on strength, these being employed for coastal reconnaissance, and these were still in service on May 10, 1940, although the unit was disbanded on August 20, 1940, and the surviving P.L.15s scrapped.

Developments of the basic design included the P.L.151 which differed from the P.L.15 in having inverted sesquiplane wing configuration, and the P.L.154 which was a former P.L.15 with wheels in place of the floats and a variable-pitch airscrew in place of the fixed-pitch unit.

Type: *Two/four-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 600 *h.p. Hispano-Suiza* 12 *Lbr or* 650 *h.p. Hispano-Suiza* 12 *Nb or Nbr twelve-cylinder Vee liquid-cooled engine.* **Armament:** *One fixed forward-firing* 7.7-*mm. Vickers machine gun and two* 7.7-*mm. Lewis guns, plus one* 1,653-*lb. torpedo or one* 992-*lb. bomb and two* 330-*lb. bombs.* **Performance:** (*H.S.*12 *Nbr*) *Maximum speed,* 118 *m.p.h. at sea level; cruising speed,* 99 *m.p.h.; range* (*torpedo sortie*), 373 *mls.,* (*reconnaissance*), 932 *mls.; time to* 3,280 *ft.,* 5 *min.* 30 *sec.; service ceiling,* 13,120 *ft.* **Weights:** *Empty,* 6,724 *lb.; loaded,* 9,590 *lb.* **Dimensions:** *Span,* 59 *ft.* 0¾ *in.; length,* 42 *ft.* 1¾ *in.; height,* 16 *ft.* 8¾ *in.; wing area,* 801.9 *sq. ft.*

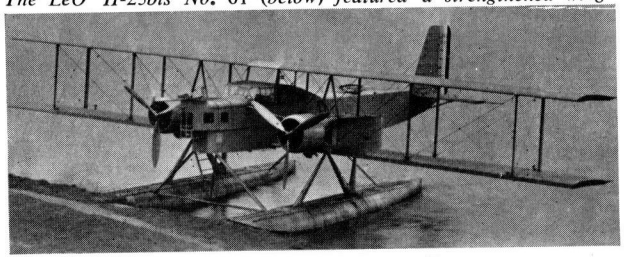
LIORÉ-ET-OLIVIER H-257BIS AND H-258

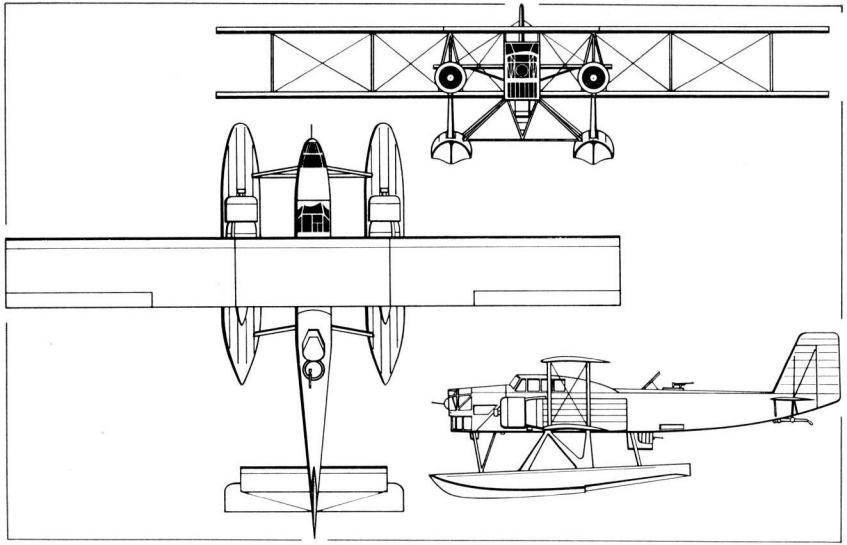
The LeO H-257bis and H-258 six-seat torpedo-bombers were progressive developments of the LeO 25 twin-engined land-based night bomber which, an improved version of the LeO 20, had flown in 1929, three having been supplied under the designation LeO 253 to the Brazilian Army. Virtually identical apart from their power plants, the H-257bis and H-258 were preceded by a number of prototypes which included the H-254-01 and H-256-01 built at the Lioré-et-Olivier company's Argenteuil plant in 1932, and which began trials at Saint Raphaël on July 7, 1932, and November 14, 1932, respectively. These differed principally in the type of engines installed and the gross wing areas, the H-254-01 having 500 h.p. Hispano-Suiza 12Mbr engines and a 1,291.67 sq. ft. wing area, and the H-256-01 having 650 h.p. Hispano-Suiza 12 Nbr engines and a 1,439.67 sq. ft. wing area. The H-255-01 followed in April 1933, this model having 690 h.p. Hispano-Suiza 12Xbrs engines, a similar wing area to that of the H-254-01 and interchangeable wheel and float undercarriages.

A prototype of a further version, the LeO H-257 had been ordered on February 25, 1932, and this aircraft, which reached Saint Raphaël for official acceptance trials on April 10, 1933, was similar to the H-256-01 apart from having 800 h.p. Gnôme-Rhône 14Kbr engines and an enclosed cockpit for the pilot, and sixty production examples were to be ordered between 1934 and 1936 as the LeO H-257bis with a strengthened wing structure and supercharged Gnôme-Rhône 14Kirs/jrs engines rated at 870 h.p. at 10,500 ft. In the meantime, after extensive trials with the H-256-01 at Saint Raphaël during which, in January 1933, the fin and rudder were modified, a contract had been placed on December 30, 1933, for twenty-six production models under the designation LeO H-258, this variant being virtually identical to the H-257bis apart from the engines which were 650 h.p. Hispano-Suiza 12 Nbr liquid-cooled power plants.

Production of the H-257bis and H-258 was undertaken at the Rochefort-sur-Mer works of Lioré-et-Olivier from where the machines were flown as landplanes to Villacoublay and thence to Saint Raphaël for delivery to the Aéronautique Maritime. The H-258 was the first variant to enter service, Escadrilles 3B1 and 3B2 beginning conversion to the type in June 1935, production being completed during the following September. Formed at Bizerte-Karouba on January 1, 1936, by transferring Escadrilles 4B1 and 4B2 to the Armée de l'Air, the 2e Groupe of the 25e Escadreconverted from F-168s to the H-257bis in June 1936.

The LeO H-25bis No. 01 *(below) featured a strengthened wing*





On June 1, 1937, a new unit, Escadrille 1B1, was formed at Berre with the H-258s formerly operated by 3B1 and 3B2, these units converting to the H-257bis. In the meantime, several improvements in the H-257bis had been introduced on the production line. As production of the 7.5-mm. Darne machine gun increased it supplanted the Lewis guns previously fitted to the torpedo-bomber, M-33.4 Type 1bis R/T equipment replaced the earlier VL-20, and a torpedo-shaped 264 Imp. gal. long-range tank took the place of the float tanks.

Reorganisation within the recently nationalised aircraft industry resulted in final assembly of the LeO H-257bis being transferred from Villacoublay to the S.N.C.A.S.E. plant at Berre where the first aircraft of this type completed (H-257bis No. 46) left the assembly line in July 1938, production finally terminating in March 1939. On October 1, 1938, Escadrilles 1B1, 3B1 and 3B2 were redesignated B2, B1 and B3 respectively, and with the conversion of B2 from the H-258 during the last weeks of 1938, all three units were equipped with the

H-257bis, and were still operating these aircraft on September 1, 1939, together with GB II/25 of the Armée de l'Air, the last-mentioned unit flying the land-based version. Some of these aircraft had already been re-engined with Gnôme-Rhône 14Knrs/ors power plants, and the H-257bis floatplanes flew patrols over the Channel, the Atlantic and the Mediterranean. By this time, eight of the surviving LeO H-258s had been completely overhauled at the newly-erected Marignane plant of the S.N.C.A.S.E., and three issued to Escadrille 2S4 based in Brittany and the remainder to 4S2 based at Karouba. Escadrille B3 was disbanded on April 1, 1940, but B1 and B2 continued to operate the H-257bis, and as German forces neared Dunkirk, the aircraft of B2 were used to bomb roads and bridges by night with some success in the Boulogne-Calais area. Much costlier, however, were the daylight bombing attacks on Panzer units approaching Cherbourg, and most of the unit's H-257bis floatplanes were lost.

Having lost most of its Loire 70 flying boats at the Karouba Naval Air Station during an attack by the Regia Aeronautica on June 12, 1940, Escadrille E7 subsequently converted to the LeO H-257bis and, at the same time, Escadrille 3S4 received a number of H-257bis and H-258 floatplanes, but the latter was disbanded on August 1, 1940. At this date, Escadrilles B1 and B2 were redesignated 16S and 5S respectively, and as GB II/25 was then authorised by the Armistice Convention to convert to the LeO 451, its LeO H-257bis landplanes were passed to the Navy, thus returning to their original owner, and on August 15, 1940, the French Navy possessed forty-five H-257bis aircraft and eight H-258s. Spares for these aircraft were produced until August 14, 1940, and subsequently they were mostly either stored or scrapped, according to their condition, although a small number were retained for target-towing, blind-flying training and communications.

After the Allied landings in November 1942, the LeO H-257bis aircraft stored in North Africa were put into flying condition, all of these being fitted with land undercarriages. By September 4, 1944, only one LeO H-257bis was still flying, this serving as a target-tug.

One other development of the LeO 25 family was tested, the LeO H-259 which was also a torpedo-bomber convertible from floatplane to landplane. The H-259 had Hispano-Suiza 12Ydrs/frs engines, a raised rear-fuselage decking, and modified strut arrangement between the engines and upper wing. In June 1935, the H-259-01 was under test at Saint Raphaël with Ratier electric airscrews, and by mid-1940 it belonged to the Base de Berre, eventually being placed in storage there.

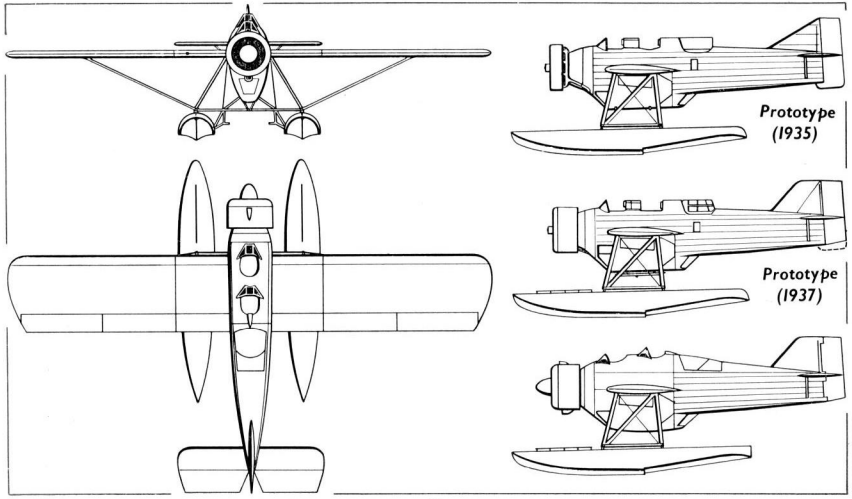
The following specification relates to the LeO H-257bis, figures in parentheses relating to the LeO H-258.

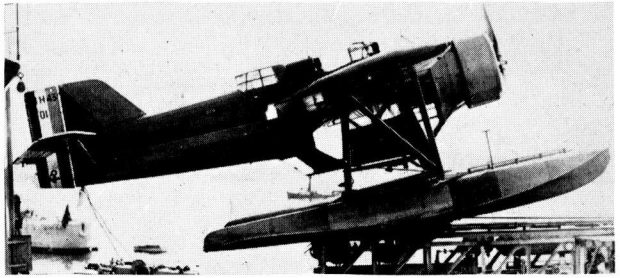
Type: *Six-seat Torpedo-bomber Twin-float Seaplane.* **Power Plants:** *Two* 870 (650) *h.p. Gnôme-Rhône* 14*Knrs/ors fourteen-cylinder radial air-cooled engines* (*Hispano-Suiza* 12*Nbr twelve-cylinder Vee liquid-cooled engines*). **Armament:** *One flexible forward-firing* 7.5-*mm. Darne machine gun, and one* 7.5-*mm. Darne gun in each of dorsal and ventral gun positions, plus one* 1,477-*lb. Type* 1926 *DA torpedo or one* 904-*lb. and four* 496-*lb. bombs.* **Performance:** (*Floatplane*) *Maximum speed,* 143 (118) *m.p.h. at* 11,480 *ft.* (*sea level*)*; economical cruising speed,* 115 (99) *m.p.h.; maximum range,* 932 (745) *mls.* **Weights:** (*Floatplane*) *Empty,* 11,684 (12,371) *lb.; loaded,* 21,076 (22,531) *lb.* **Dimensions:** (*Landplane in parentheses*) *Span,* 83 *ft.* 7 *in.; length,* 58 *ft.* 2¾ *in.* (54 *ft.* 1½ *in.*)*; height,* 22 *ft* 2⅛ *in.* (21 *ft.* 5¾ *in.*)*; wing area,* 1,439.67 *sq. ft.*

LIORÉ-ET-OLIVIER H-43 FRANCE

Designed by M. Benoit of the Lioré-et-Olivier company and built at Argenteuil, the LeO H-43 three-seat observation-scout floatplane competed with the Loire 130 and C.A.M.S.120 flying boats and Gourdou-Leseurre GL-820, Breguet 610 and Levasseur P.L.200 floatplanes to meet the requirements of an official specification issued to the French aircraft industry in 1933. The prototype, the LeO H-43-01, initially equipped with a 575 h.p. Hispano-Suiza 9Va engine, flew for the first time on December 4, 1934, and was delivered to Saint Raphaël for official evaluation on January 8, 1935.

The floatplane proved to possess good flying characteristics, and official trials were completed on October 22, 1935, with two successful catapult launchings from the seaplane carrier *Commandant Teste* off Toulon. A further series of official trials was undertaken and twenty production machines were ordered on May 5, 1936, although the contract was not actually placed until July 29, 1937, and production was delayed until September 15, 1938 when the S.N.C.A. du Sud-Est, which, in the meantime, had absorbed the Lioré-et-Olivier company, was informed of the changes to be incorporated in the production model.





The LeO H-43-01 (above) flew for the first time on December 4, 1934, but extensive modifications resulted in a period of five years elapsing before production deliveries began.

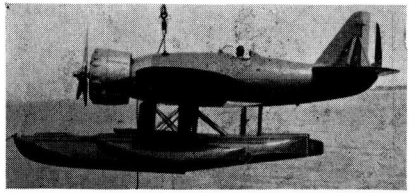
The original wing was retained, this comprising a centre section built integral with the fuselage and folding outer panels, but the fuselage was to be appreciably redesigned to provide improved view for the crew members. Humped upper fuselage contours were incorporated with a second cockpit situated at the peak of the hump, and the dorsal turret was supplanted by a sliding hatch which enclosed a Blanchet-Pilain-11 mounting with a single 7.5-mm. Darne machine gun. A 650 h.p. Hispano-Suiza 9Vb engine similar to that installed in the prototype during the later stages of its official trials was adopted for the production model, this being attached to a special vibration-absorbing mount and enclosed by a redesigned cowling, a streamlined spinner being added. The forward portions of the float planing bottoms were redesigned and the capacity of the float fuel tanks was increased from 89.5 Imp. gal. to 121 Imp. gal. The wing was a fabric-covered all-metal two-spar structure, and the fuselage was of welded steel-tube construction, also with fabric covering.

The Berre plant of Sud-Est undertook the production of the LeO H-43, the first production aircraft flying for the first time on July 13, 1939—nearly five years after the appearance of the prototype. Between February 12 and 29, 1940, Escadrille 3S1 received nine H-43 floatplanes, and on March 1, 1940, Escadrille 3S5 began conversion to the type, the twentieth and last production aircraft flying on May 3, 1940. By May 10, Escadrilles 3S1 and 3S5 were based at Saint Mandrier with respective strengths of nine and six machines, but both units were disbanded on August 20, 1940, by which time they had been redesignated 7S and 11S respectively, and their H-43 floatplanes placed in storage at Berre.

Type: *Three-seat Observation-scout Twin-float Seaplane.* **Power Plant:** *One* 650 *h.p. Hispano-Suiza 9Vb nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 7.5-*mm. Darne machine gun and one* 7.5-*mm. Darne gun on flexible mount, plus two* 165-*lb. bombs.* **Performance:** *Maximum speed,* 130 *m.p.h. at* 3,280 *ft.; economical cruising speed,* 93 *m.p.h.; time to* 6,560 *ft.,* 9 *min.; service ceiling,* 19,685 *ft.; range,* 512 *mls. at* 93 *m.p.h.; endurance,* 5 *hr.* 30 *min.* **Weights:** *Loaded,* 7,496 *lb.* **Dimensions:** *Span,* 52 *ft.* 6 *in.; length,* 35 *ft.* 8½ *in.; height,* 15 *ft.* 4¼ *in.; wing area,* 387.5 *sq. ft.*

LOIRE 210 FRANCE

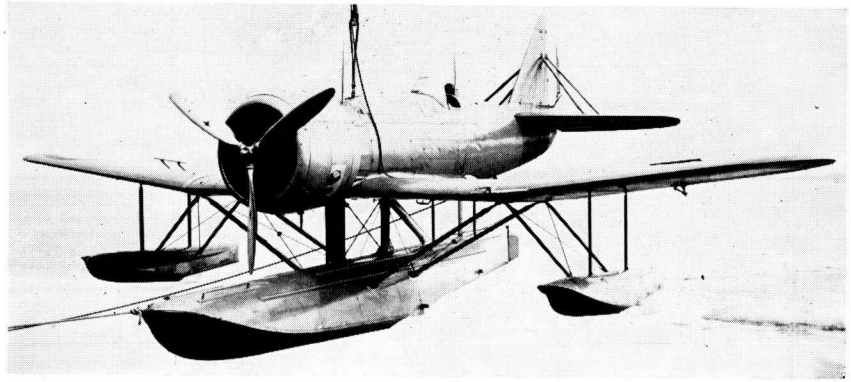
The Loire 210 single-seat float fighter was designed to meet the requirements of a specification issued by the French Navy in 1933, and was selected in competition with the Bernard 110 and Romano 90. Flown for the first time at Saint Nazaire on March 21, 1935, the Loire 210 employed a fuselage essentially similar to that of the Loire 46 shoulder-wing land-based fighter monoplane. The forward fuselage was a welded steel-tube structure covered by detachable metal panels, and the rear fuselage was a semi-monocoque. The wings were of metal construction with metal skinning inboard and fabric outboard. Armament comprised two wing-mounted 7.5-mm. Darne machine guns.

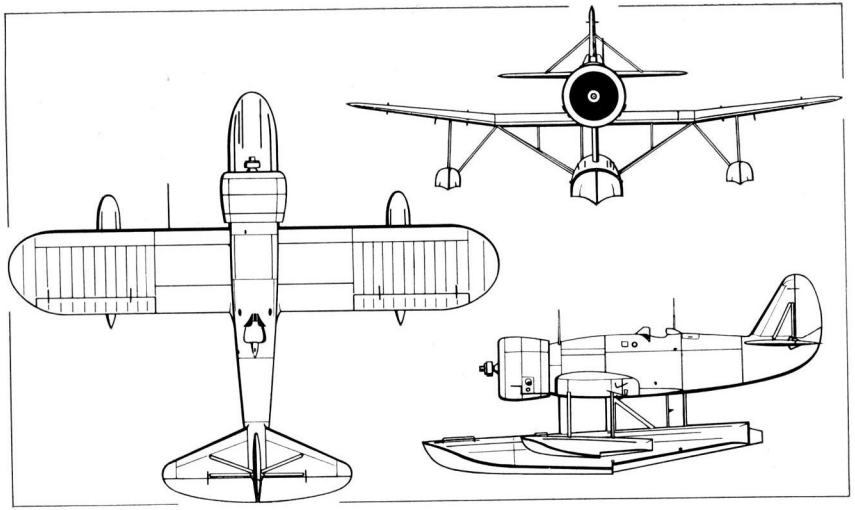


The Loire 210-01 *flown in March* 1935.

The prototype began official trials at Saint Raphaël in June 1935, but a production order calling for twenty machines was not placed until March 19, 1937, the first production model flying on November 18, 1938. Components were manufactured at the Nieuport plant at Issy-Les-Moulineaux and final assembly was undertaken at Saint Nazaire, produc-

One of the twenty production Loire 210 *single-seat float fighters delivered in* 1938–39.





tion machines differing from the prototype in having four wing-mounted guns and SADIR 514 R/T equipment. Catapult trials with the first production Loire 210 were completed by the end of January 1939, and during the following August two escadrilles were formed with the float fighter; HC 1 at Saint Mandrier, near Toulon, and HC 2 at Lanvéoc, near Brest, the aircraft of the latter unit being intended for service aboard the battleships *Dunkerque* and *Strasbourg*. However, after several accidents resulting from wing structural failures, the surviving fifteen production Loire 210s were grounded and, on November 22, 1939, HC 1 and HC 2 were disbanded by the French naval command.

A development of the basic design, the Loire 211 with a Gnôme-Rhône 14M-2 air-cooled radial, was projected but not proceeded with. **Type:** *Single-seat Fighter Floatplane.* **Power Plant:** *One* 720 *h.p. Hispano-Suiza* 9*Vbs nine-cylinder radial air-cooled engine.* **Armament:** *Four* 7.5-*mm. Darne machine guns in the wings.* **Performance:** *Maximum speed,* 186 *m.p.h. at* 9,840 *ft.,* 174 *m.p.h. at sea level; climb to* 9,840 *ft.,* 5 *min.* 19 *sec.; service ceiling,* 26,250 *ft.; range,* 466 *mls.* **Weights:** *Empty,* 3,174 *lb.; loaded,* 4,740 *lb.* **Dimensions:** *Span,* 38 *ft.* 8⅛ *in.; length,* 31 *ft.* 2¾ *in.; height,* 12 *ft.* 5¼ *in.; wing area,* 218.5 *sq. ft.*

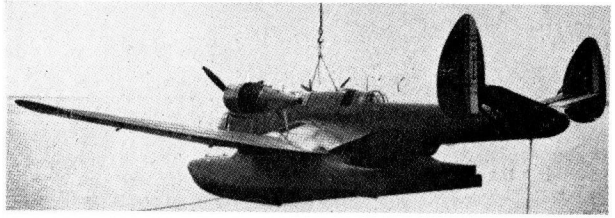
LOIRE-NIEUPORT 10

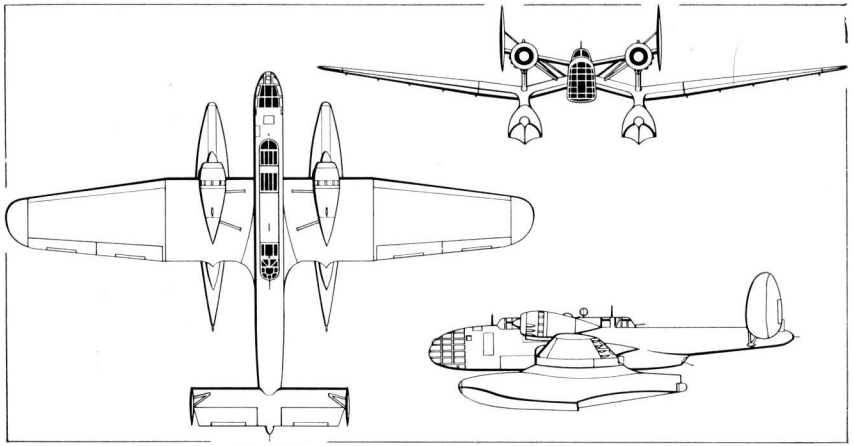
FRANCE

Throughout the 'twenties and 'thirties the French Navy was a leading protagonist of the large, multi-seat, twin-engined torpedo-bomber floatplane, and one of the last aircraft in this category to be tested was the L.N.10 built by the Société Nationale de Constructions Aéronautiques de l'Ouest (S.N.C.A.O.) to compete with the Centre N.C.410 and the Bloch MB-480. The design office of the Ateliers et Chantiers de la Loire had begun work on a twin-engined torpedo-bomber floatplane, the Loire 240, in 1935 to meet the requirements of specification MT/CPT 9 issued on May 1 of that year, but this specification was supplanted by a new specification in 1937, by which time the Loire concern had been absorbed by the S.N.C.A.O., and the Loire 240 was abandoned in favour of a more advanced project, the L.N.10.

Built at Saint Nazaire, the L.N.10-01 was flown for the first time from the Loire Estuary on July 21, 1939. Its wing, which was of inverted gull configuration, was an all-metal, two-spar structure with stressed skin. The entire trailing edge was occupied by ailerons and split flaps, and the outer panels carried hydraulically-actuated leading-edge slats. Each wing housed a stressed 468.5 Imp. gal. fuel tank, the upper and lower surfaces of which were formed by the wing skin, and the Gnôme-Rhône radial air-cooled engines were braced above the wings and immediately above the floats which were attached to the wings by short cantilever pylons. The fuselage was of stressed-skin construction and accommodated six crew members, with tandem dual controls on the port side for pilot and co-pilot, a bombardier-navigator's compartment in the extreme nose with a TA 35 bombsight and a 7.5-mm. Darne machine gun on a BP 100 flexible mount, a radio-operator's compartment immediately aft of the co-pilot with Bronzavia M 150A low frequency and SADIR 512 high frequency R/T, and an LMT RC5B direction finder, a flight engineer's station aft, and a dorsal gunner's position at the extreme end of the raised upper fuselage decking with a 20-mm. Hispano-Suiza 404 cannon in a SAMM AB15 powered turret. A ventral gun was provided, this being a 7.5-mm. Darne machine gun on a BP 20 flexible mount which fired through a hatch in the rear fuselage step. The bomb-bay occupied the entire lower section of the fuselage between the navigator's station and the dorsal gun turret, this accommodating either five 518-lb. Type K bombs or three 904-lb. Type L bombs. Alternatively, two 1,477-lb. or 1,653-lb. torpedoes could be carried.

Shortly after the first flight of the L.N.10-01, the dihedral of the wingtips was reduced to that of the wing outer panels, and Bronzavia flame-dampers were fitted to the engine





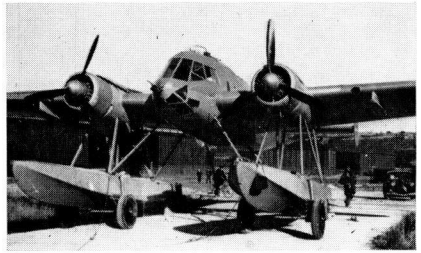
exhausts. On December 10, 1939, the French Admiralty advised the Ministère de l'Air that no production order would be placed for the L.N.10 or its competitors owing to the decision to use land-based aircraft for the torpedo-bombing role, and it was requested that the completed machines be delivered to Saint Raphaël for experimental purposes. Accordingly, the L.N.10-01 left Saint Nazaire for Saint Raphaël on December 30, 1939. At Saint Raphaël inadequate stability displayed during trials necessitated the return of the floatplane to Saint Nazaire for enlargement of the endplate vertical tail surfaces. Late in May 1940, the L.N.10-01 was flown to Hourtin to complete its official trials, and was being overhauled there when German forces occupied Bordeaux late in the following month. The floatplane was, therefore, scuttled to prevent it falling into German hands, and at that time it had logged 150 flying hours.

Type: *Six-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 1,600 *h.p. Gnôme-Rhône* 14*R* 0/1 *fourteen-cylinder radial air-cooled engines.* **Armament:** *Two* 7.5-*mm. Darne machine guns on flexible mounts and one* 20-*mm. Hispano-Suiza* 404 *cannon in power-operated dorsal turret, plus two* 1,477-*lb. or* 1,653-*lb. torpedoes, five* 518-*lb. Type K bombs or three* 904-*lb. Type L bombs.* **Performance:** *Maximum speed,* 267 *m.p.h. at* 14,760 *ft.; economical cruising speed,* 174 *m.p.h.; climb to* 16,400 *ft.,* 22 *min.; service ceiling,* 22,965 *ft.; range (torpedo-bomber),* 932 *mls., (reconnaissance),* 2,050 *mls.* **Weights:** *Empty,* 18,739 *lb.; loaded,* 30,743 *lb.* **Dimensions:** *Span,* 88 *ft.* 7 *in.; length,* 59 *ft.* 4½ *in.; height,* 21 *ft.,* 11¾ *in.; wing area,* 968.751 *sq. ft.*

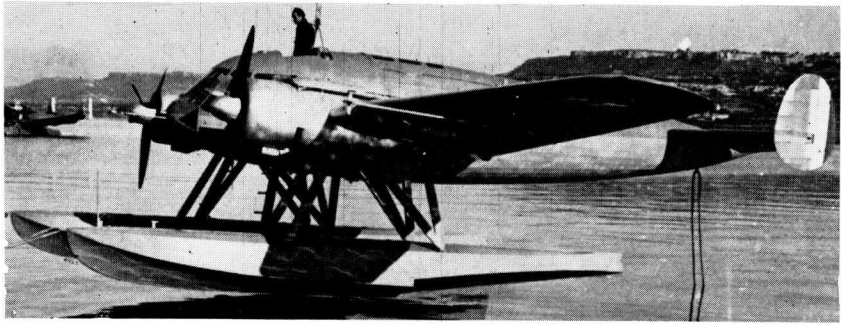
SUD-EST S.E.400

To provide a successor for the ageing C.A.M.S.37 flying boat, specification A46 calling for an "Hydravion triplace de Surveillance côtière" was issued in 1937 by the Service Technique de l'Aéronautique, and in March 1938, the S.N.C.A.S.E. began the construction of two prototypes at the Argenteuil plant; the S.E.400-01 twin-float seaplane powered by two 655 h.p. Gnôme-Rhône 14M 8/9 engines, and the S.E.400-02 landplane powered by two 500 h.p. Lorraine 120 Algol engines.

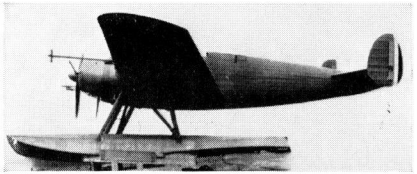
The S.E.400-01 was completed at Argenteuil and transported by rail to Marignane where it made its first flight on December 31, 1939. The prototype was of mixed construction, the wing being of wood and the fuselage being a welded steel-tube structure with light alloy panels forward and fabric covering aft. The single-step light-alloy floats were each braced to the engine nacelles by pairs of N-struts and to the fuselage by sloping parallel struts. The initial flight, which lasted thirty minutes, revealed a number of shortcomings. Between December 31, 1939, and January 10, 1940, a ventral fin was added beneath the rear fuselage, water rudders were added to the floats and the exhaust pipes over the upper wing surfaces were replaced by "fish-tails". From January 11 to February 8 wing root fairings



(*Above, right and below*) *The S.E.*400–01 *photographed at Marignane early in* 1940.



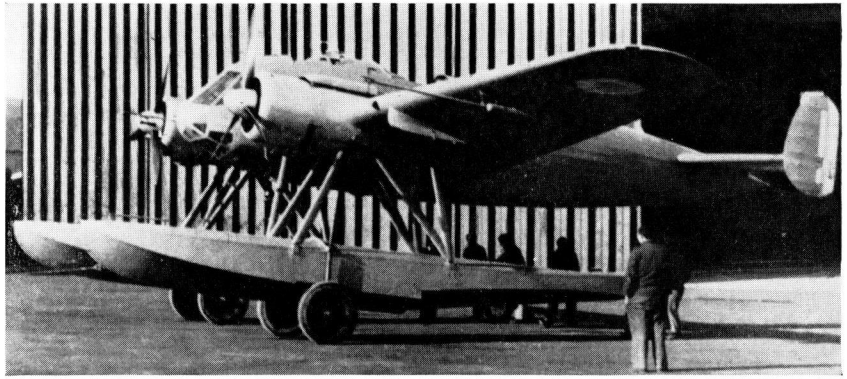
were added and a new, enlarged tail assembly was fitted, this being mounted 13.3 inches higher than the original assembly, but the characteristics of the floatplane were still unsatisfactory, and from February 10 until March 14 the S.E.400-01 was undergoing further modifications, the fuselage nose section being lengthened by 29.5 inches, the ventral fin was further enlarged, new elevators were fitted and the carburettor air intakes were moved forward to the lips of the engine cowlings.

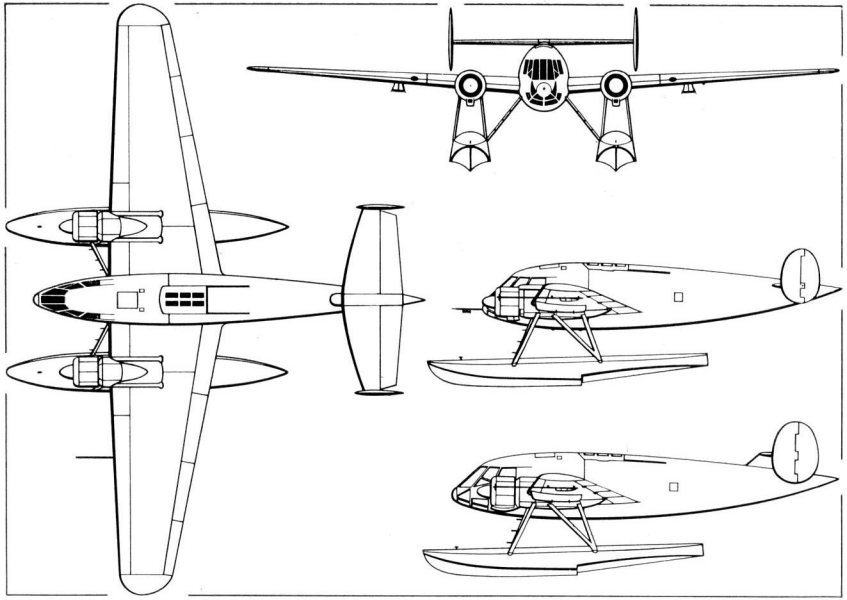


These changes were followed by the introduction of new floats 15.7 inches longer than their predecessors, the original tailplane was re-installed and increased in area by 4.3 sq. ft. by means of tip extensions, and the fins and rudders were lowered. Continued instability necessitated the reintroduction of the second tailplane accompanied by appreciably larger mid-mounted endplate fins and rudders, the removal of the ventral fin and water rudders and the forward movement of the c.g.

Further trials conducted on May 12, 1940, by which time the S.E.400-01 had logged 12 hrs. 5 mins. in the air, revealed that most stability problems had been overcome, but by this time the German offensive had started, and on May 24 the S.N.C.A.S.E. was ordered to abandon further work on the S.E.400 owing to the delays that had occurred in developing the floatplane to production status. Work on the S.E.400-02 had already been shelved when

*(Above and below) The S.E.*400-01 *before the lengthening of the forward fuselage.*





fifty per cent complete pending the results of further trials with the first prototype, and at one period a version of the basic design was proposed with Pratt and Whitney S3H1-G Wasp engines.

Type: *Three-seat Coastal Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 655 *h.p. Gnôme-Rhône* 14*M* 8/9 *fourteen-cylinder air-cooled radial engines.* **Armament:** *One* 7.5-*mm. Darne machine gun on Blanchet-Pilain*-30 *dorsal mount with* 600 *rounds, plus two Michelin flares and two* 165-*lb. bombs.* **Performance:** *Maximum speed,* 180 *m.p.h. at* 6,560 *ft.; cruising speed,* 162 *m.p.h.; economical cruising speed,* 99 *m.p.h.; service ceiling,* 13,120 *ft.; range,* 595 *mls. at* 99 *m.p.h.; endurance,* 6 *hr.* **Weights:** *Loaded,* 12,125 *lb.* **Dimensions:** *Span,* 63 *ft.* 5¾ *in.; length,* 44 *ft.* 3½ *in.; height,* 14 *ft.* 9⅛ *in.; wing area,* 559.723 *sq. ft.*

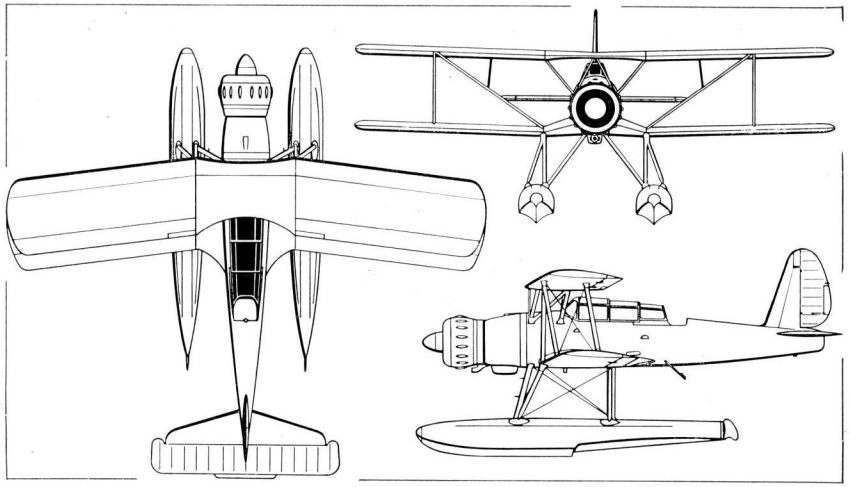
ARADO AR 95 GERMANY

The Ar 95 was designed by Dipl. Ing. W. Blume of the Arado Flugzeugwerke in 1935 as a two-seat general-purpose bomber-torpedo-reconnaissance aircraft which could be fitted either with twin all-metal floats or a fixed wheel undercarriage, and the first prototype (D-OLUO) with a float undercarriage was tested early in 1936. The second prototype (D-OHGV) differed from the first machine in having a continuous canopy enclosing the tandem cockpits, some modifications to the float bracing struts, and redesigned vertical tail surfaces with an enlarged fin.

Six Ar 95 floatplanes were sent to Spain in August 1938 for experimental use by the Condor Legion, but the type was not adopted by the Luftwaffe or the German Navy and was offered for export, the float seaplane version being known as the Ar 95W and the landplane variant being designated Ar 95L. The production prototype (D-ODGX) had provision for a single 7.9-mm. machine gun in the starboard side of the forward fuselage with 500 rounds firing through the airscrew disc, and a similar gun on a flexible mount with 750 rounds in the rear cockpit. A 1,540-lb. torpedo or an 825-lb. bomb could be attached to a rack beneath the fuselage, or, alternatively, racks could be fitted for six 110-lb. bombs. All-metal construction was employed with light alloy skinning.

The Turkish government placed an order for the Ar 95W in 1938, and the Chilean government ordered a batch of Ar 95L aircraft which were fitted with a land undercarriage comprising two trousered units incorporating the oleo-pneumatic shock absorbers. Deliveries of the Chilean aircraft were completed in 1939, and those for the Turkish government were in process when further exports of military aircraft were halted, the remaining Ar 95W floatplanes being sequestered by the Luftwaffe and used for training purposes, together with the prototypes.

One of the small number of Ar 95 floatplanes impressed by the Luftwaffe in 1939 as trainers.

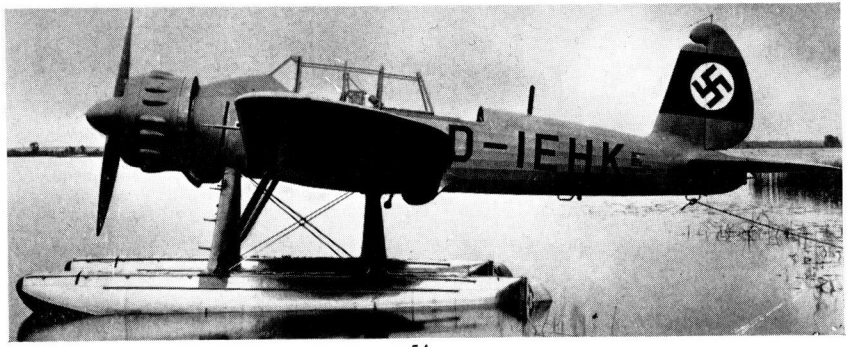


Type: *Two-seat General-purpose Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 880 *h.p. BMW* 132*Dc nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 7.9-*mm. MG* 17 *machine gun with* 500 *rounds and one* 7.9-*mm. MG* 15 *machine gun on flexible mount with* 750 *rounds, plus one* 1,540-*lb. torpedo, one* 825-*lb. bomb, or six* 110-lb. *bombs.* **Performance:** *Maximum speed,* 171 *m.p.h. at sea level,* 192 *m.p.h. at* 9,840 *ft.; cruising speed,* 157 *m.p.h. at* 4,000 *ft.; climb to* 3,280 *ft.,* 2.3 *min., to* 6,560 *ft.,* 4.5 *min., to* 13,120 *ft.,* 9 *min.; service ceiling,* 24,000 *ft., maximum ceiling,* 25,580 *ft.; range,* 680 *mls.* **Weights:** *Empty,* 5,588 *lb.; loaded,* 7,843 *lb.* **Dimensions:** *Span,* 41 *ft.* 0 *in.; length,* 36 *ft.* 5 *in.;* 17 *ft.* 0¾ *in.; wing area,* 488.5 *sq. ft.*

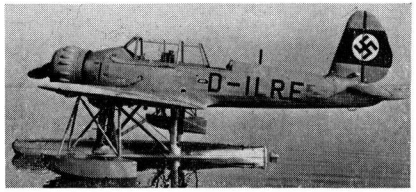
Introduced in 1939 as a successor to the He 60 on the catapults of the principal German warships, the Ar 196 was first encountered in December 1939 when an example of this reconnaissance floatplane was seen aboard the ill-fated *Graf Spee*. In the spring of 1941, several floatplanes of this type were launched by the *Bismarck* in an attempt to drive away the R.A.F. Catalina flying boats shadowing the battleship during its one and only sortie into the Atlantic, and subsequently it was encountered frequently over the Bay of Biscay where, operating from French bases, the Ar 196 was used to intercept R.A.F. Coastal Command anti-submarine patrols, necessitating the use of Beaufighters as a countermeasure.

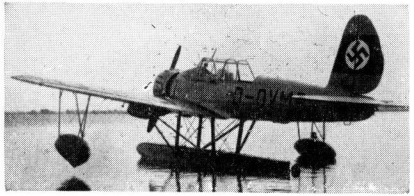
The Ar 196 was designed by the Arado Flugzeugwerke in 1937, and four prototypes were completed and flown in 1938. The first two prototypes, the Ar 196V1 (D-IEHK) and V2 (D-IHQI), had twin long single-step all-metal floats attached to the fuselage and wings by a system of steel-tube struts, but the third and fourth prototypes, the Ar 196V3 (D-ILRE) and V4 (D-OVMB), had a single central float with stabilising floats outboard under the wings. The prototypes were powered by the BMW 132Dc nine-cylinder radial rated at 880 h.p. and driving a two-blade controllable pitch airscrew, and the Ar 196V1 was originally flown with twin exhaust pipes which extended beneath the port side of the forward fuselage. These were later reduced in length and divided to port and starboard, this arrangement being standardised on subsequent prototypes and the production model. The Ar 196V1 was also the first prototype to test a three-blade variable-pitch VDM airscrew later adopted for the Ar 196A series. Apart from an increase in vertical fin area and redesign of the rudder, the Ar 196V2 was identical to its predecessor, and the Ar 196V4 was the first prototype to test the armament proposed for the production model, two 20-mm. MG FF cannon being installed in the inboard wing sections, a single 7.9-mm. MG 17 machine gun being mounted in the starboard side of the forward fuselage, and containers housing 110-lb. bombs being attached to the undersurfaces of the wings, immediately outboard of the lateral bracing struts for the central float.

The Ar 196V1 floatplane flew for the first time in 1938 with a BMW 132Dc air-cooled radial.

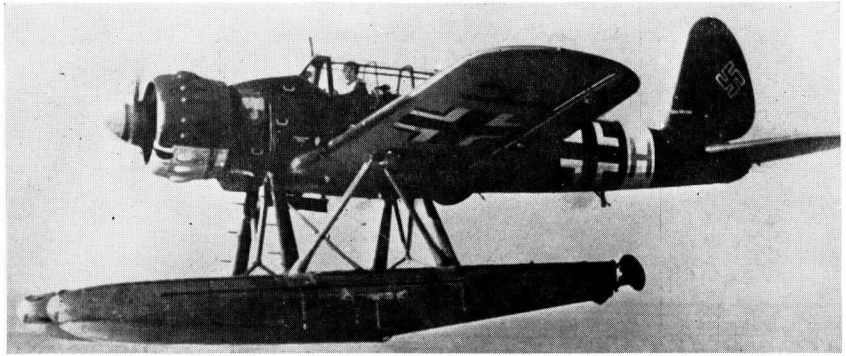


The Ar 196V2 (above) was essentially similar to the first prototype, but the Ar 196V3 (immediately below) had a central float. (Bottom) The Ar 196V4 was used for armament tests.

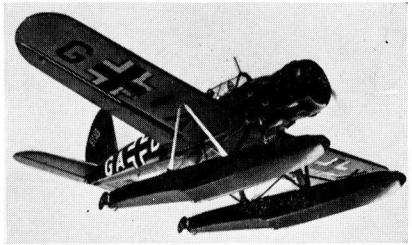




Evaluation of the prototypes resulted in the decision to standardise on the twin-float arrangement of the first two machines, and production was initiated late in 1938, the initial model, the Ar 196A-1 having the more powerful BMW 132K rated at 960 h.p. for take-off, 970 h.p. at 1,480 ft., and having a maximum crusing power of 750 h.p. at 4,900 ft. The Ar 196A-1 had a welded steel-tube fuselage structure, the forward part of which was covered by stressed metal skin and the aft

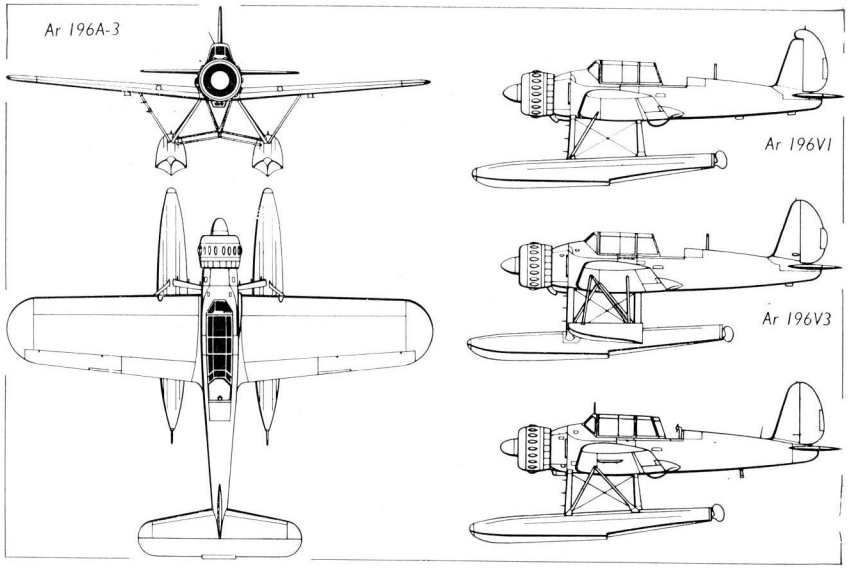


(Above and below) The Ar 196A-3 was the principal production model of the floatplane.



part by fabric. The two-spar all-metal wing was metal-covered and braced to the floats at approximately one-third span. The tail assembly was an all-metal structure with metal-covered fixed surfaces and fabric-covered movable surfaces, and the floats were provided with catapult points. Armament comprised one 7.9-mm. MG 17 machine gun in the forward fuselage, and normally a similar gun on a movable mounting was provided in the rear cockpit. Two 110-lb. bombs could be attached to underwing racks.

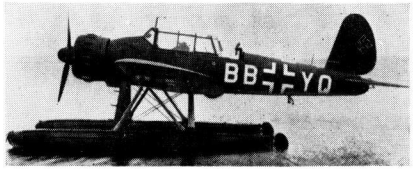
The first production deliveries of the Ar 196A-1 were made in August 1939, twenty-six having been completed by the end of the year, these being allocated to the principal German warships, such as the *Scharnhorst*, the *Gneisenau*, the *Graf Spee*, the *Lützow*, the *Scheer* and the *Prinz Eugen*, replacing the He 60 biplane. During 1940, the Ar 196A-1 was succeeded by the Ar 196A-3 intended primarily for coastal reconnaissance and patrol. Apart from installation of later radio equipment, the Ar 196A-3 differed from the initial production model in having the forward-firing MG 17 machine gun supplemented by two wing-mounted 20-mm. MG FF cannon firing outside the airscrew arc, and twin MG 17s were installed in the rear cockpit. A total of 104 floatplanes of this type was completed in 1940,



followed by ninety-four in 1941, by which year the Ar 196A was being encountered increasingly in the Mediterranean and the Adriatic where it was used for anti-submarine patrols and for attacking light marine craft. It was also used in the convoy escort role, and in the Channel was employed in hunting R.A.F. Coastal Command's Whitleys which patrolled the routes taken by U-boats entering and leaving their pens along the French coast.

Under an agreement signed between Germany and the Vichy French government in

The Ar 196A-3 was carried by the catapults of the principal German warships. It was also used for coastal reconnaissance and patrol.



July 1941, the S.N.C.A. plant at St. Nazaire undertook the production of the Ar 196A, producing thirteen in 1942 and ten in 1943, and in the Netherlands Fokker began pro-producing the Ar 196A-5 in 1943, delivering eleven in that year and fifty-eight in 1944. The Ar 196A-5 was essentially similar to the A-3 apart from certain items of internal equipment. The Arado Flugzeugwerke had terminated production of the floatplane in 1943, delivering eighty-three aircraft in that year, and total production of the Ar 196A from all sources and excluding prototypes was 493 machines.

The following specification relates to the Ar 196A-3.

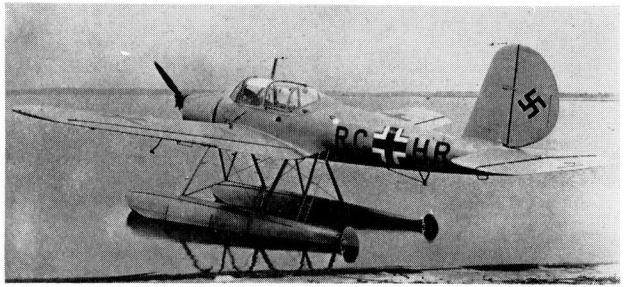
Type: *Two-seat Shipboard Reconnaissance and Coastal Patrol Twin-float Seaplane.* **Power Plant:** *One* 970 *h.p. BMW* 132*K nine-cylinder radial air-cooled engine.* **Armament:** *Twin* 20*-mm. MG FF cannon and one* 7.9*-mm. MG* 17 *machine gun firing forward and two* 7.9*-mm. MG* 17 *machine guns on flexible mount in rear cockpit, and two* 110*-lb. bombs.* **Performance:** *Maximum speed,* 193 *m.p.h. at* 13,120 *ft.; cruising speed,* 157 *m.p.h.; initial climb rate,* 985 *ft./min.; service ceiling,* 23,000 *ft.; range,* 670 *mls. at* 157 *m.p.h. at* 4,000 *ft.* **Weights:** *Empty,* 6,580 *lb.; loaded,* 8,200 *lb.* **Dimensions:** *Span,* 40 *ft.* 10½ *in.; length,* 36 *ft.* 1 *in.; height,* 14 *ft.* 5 *in.; wing area,* 305 *sq. ft.*

ARADO AR 199

GERMANY

The Ar 199 was designed in 1938 to meet the requirements of a specification calling for a light float seaplane suitable for initial and basic floatplane flying training, and for the training of navigators and radio operators. Two prototypes were completed and flown in 1939, the Ar 199V1 (D-IRFB) and the Ar 199V2 (D-ISBC), their design owing much to that of the Ar 79 two-seat light cabin monoplane. All-metal construction was employed, the forward fuselage being a welded steel-tube structure with light alloy skinning and the aft fuselage being a stressed-skin monocoque, and the single-spar wing having light alloy and fabric skinning. All movable control surfaces were fabric covered, and catapult points were provided.

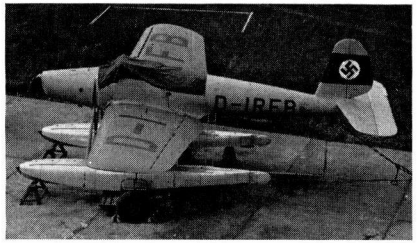
The Ar 199*V*2 *(below) was completed and flown in* 1939.



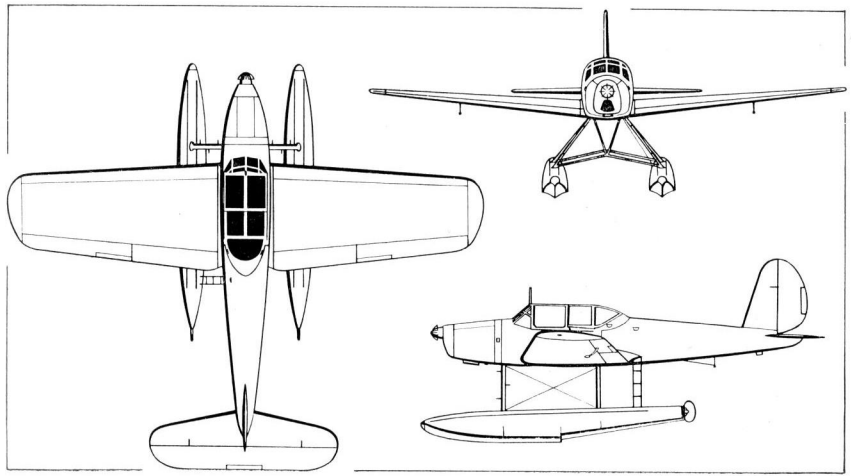
Side-by-side seating was provided for the instructor and pupil with dual controls, and for wireless operator and navigator training provision was made for a third seat aft.

Although trials with the two Ar 199 prototypes were extremely successful, the requirement for a training seaplane of this type was abandoned and, in consequence, no production was undertaken. However, both prototypes were delivered to the Luftwaffe after completing type trials and subsequently served in the training role.

Type: *Two/three-seat Trainer Float Seaplane.* **Power Plant:** *One* 450 *h.p. Argus As* 410*C twelve-cylinder inverted-Vee air-cooled engine.* **Performance:** *Maximum speed,* 141 *m.p.h. at sea level,* 161 *m.p.h. at* 9,840 *ft.; time to* 9,840 *ft.,* 11 *min.; ceiling,* 21,320 *ft.* **Weights:** *No details available.* **Dimensions:** *Span,* 41 *ft.* 8 *in.; length,* 34 *ft.* 8 *in.; height,* 14 *ft.* 3¼ *in.; wing area,* 327.225 *sq. ft.*

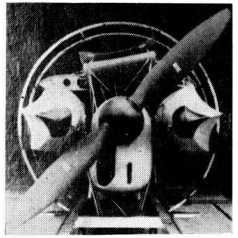


The design of the Ar 199*V*1 *(above) owed much to the Ar* 79 *two-seat light cabin monoplane.*



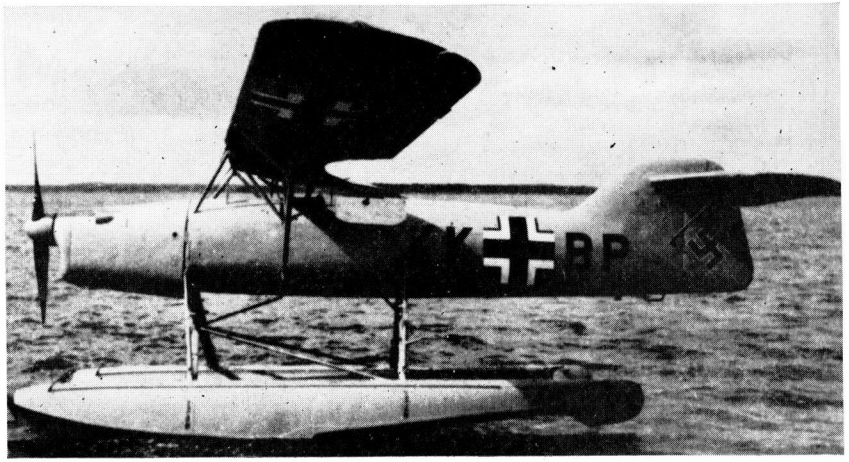
ARADO AR 231 GERMANY

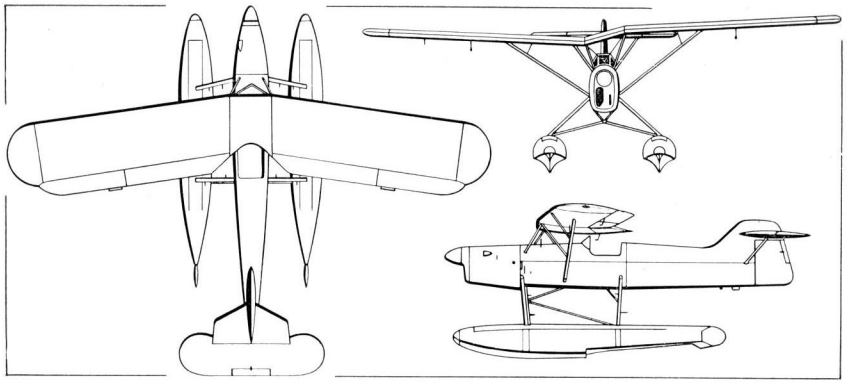
The Ar 231 was a small submarine-borne reconnaissance floatplane designed so that it could be dismantled with extreme rapidity and stowed within a tube of 6.56-ft. diameter. A single-seater powered by a 160 h.p. Hirth HM 501 air-cooled engine, the Ar 231 employed an extremely simple structure, and in order to facilitate wing folding, the small wing centre section was braced above the fuselage at an angle so that the root of the starboard mainplane was lower than that of the port mainplane, permitting the latter to swing over the former when these swivelled on the rear spar for stowage aboard the submarine.



Like the Besson MB-411 (see page 8) and the Yokosuka E14Y1 (see page 138), the Ar 231 was intended to be lowered onto the water from the submarine and subsequently retrieved by means of a folding crane after completing its mission. The process of dismantling the floatplane for insertion in the tubular hangar occupied approximately six minutes, erection taking a similar time. An evaluation batch of six Ar 231 submarine-borne floatplanes was ordered early in 1940, and the first of these, the Ar 231V1), was flown in 1941. The floatplane was envisaged as a *Ubootsuge*—a U-boat-eye enabling enemy vessels to be spotted while still many miles over the horizon. Sufficient fuel was provided for an endurance of nearly four hours, this being considered sufficient to enable the U-boat commander to make his attack and then retrieve the floatplane a considerable distance from the scene of the action.

The Ar 231V2 (below) was the second of six prototypes of this light submarine-borne floatplane. This type could be dismantled and stowed in a 6.56-ft. diameter tube (see left).





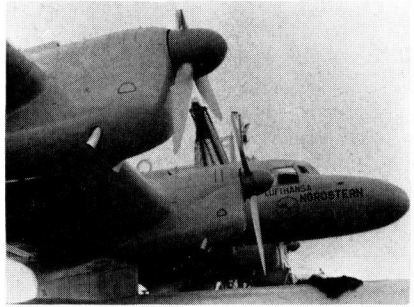
Trials with the Ar 231 were not entirely successful, the characteristics of the little aircraft both in the air and on the water leaving much to be desired, and the need to remain on the surface for some ten minutes in daylight while the floatplane was retrieved and dismantled did not appeal to U-boat commanders. In the meantime, however, the Focke-Achgelis Fa 330 rotary-wing observation kite had been developed successfully, this offering a simpler means of providing the U-boat with an airborne observation platform, and one which could be easily jettisoned in the event of the U-boat having to crash-dive, and further work on the Ar 231 was abandoned, only the six evaluation machines being completed.

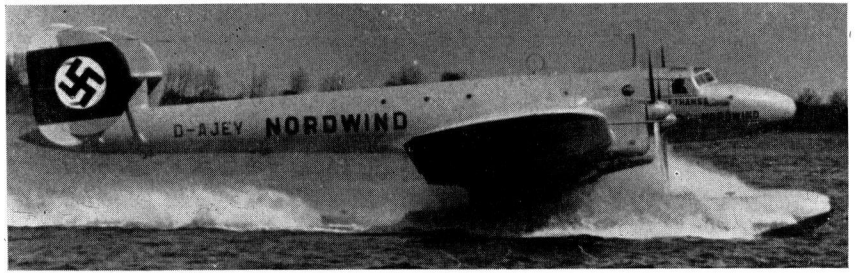
Type: *Single-seat Submarine-borne Observation Float Seaplane.* **Power Plant:** *One* 160 *h.p. Hirth HM* 501 *six-cylinder inverted in-line air-cooled engine.* **Performance:** *Maximum speed,* 106 *m.p.h. at sea level; cruising speed,* 81 *m.p.h. at sea level; service ceiling,* 9,840 *ft.; range,* 310 *mls.* **Weights:** *Empty,* 1,836 *lb.; loaded,* 2,315 *lb.* **Dimensions:** *Span,* 33 *ft.* 4½ *in.; length,* 25 *ft.* 7½ *in.; height,* 10 *ft.* 2¾ *in.; wing area,* 163.61 *sq. ft.*

BLOHM UND VOSS HA 139 GERMANY

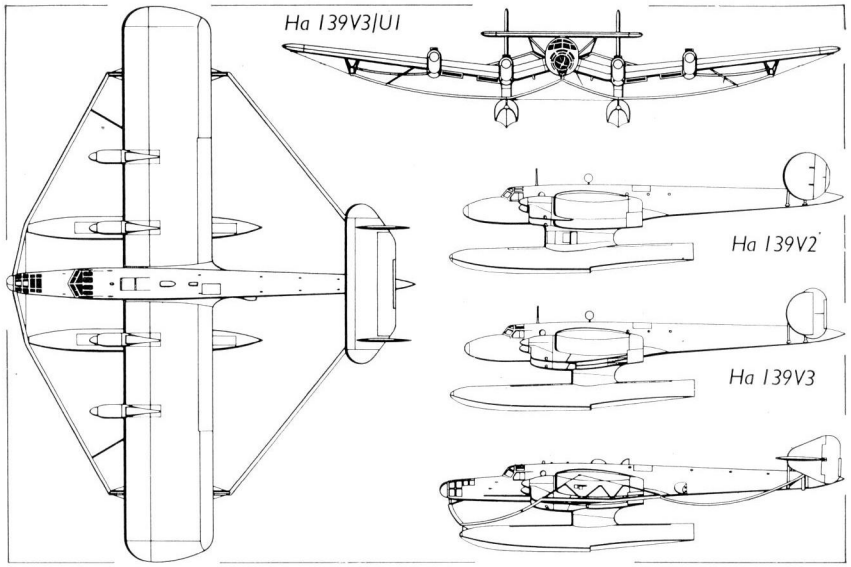
One of the most aesthetically attractive multi-engined float seaplanes built, the Ha 139 was first projected early in 1935 as a long-range commercial seaplane to the requirements of Deutsche Lufthansa for trans-oceanic flying. Of all-metal construction, the Ha 139 had a circular monocoque fuselage and an inverted gull wing featuring one main load-carrying tubular spar located at the thickest point of the wing section and sealed to form a fuel tank. The two all-metal single-step floats were each attached to the centre section spar at the point of transition between negative and positive dihedral by a vertical steel stub enclosed by a streamlined fairing.

The first two prototypes, the Ha 139V1 *Nordmeer* (D-AMIE) and the Ha 139V2 *Nordwind* (D-AJEY), were delivered to Lufthansa in 1937, and during the summer and autumn of that year, these sea-planes, each powered by four 600 h.p. Junkers Jumo 205C diesel engines, made fourteen experimental trans-Atlantic flights between Horta in the Azores and New York. During the following winter several modifications were made to the floatplanes. Poor directional stability with the original circular endplate fin-and-rudder assemblies dictated a substantial increase in the size of the rudders, and inadequate engine cooling necessitated the removal of the radiators from the float stub fairings and the introduction of separate under wing radiators for each engine. In the spring of 1938, the

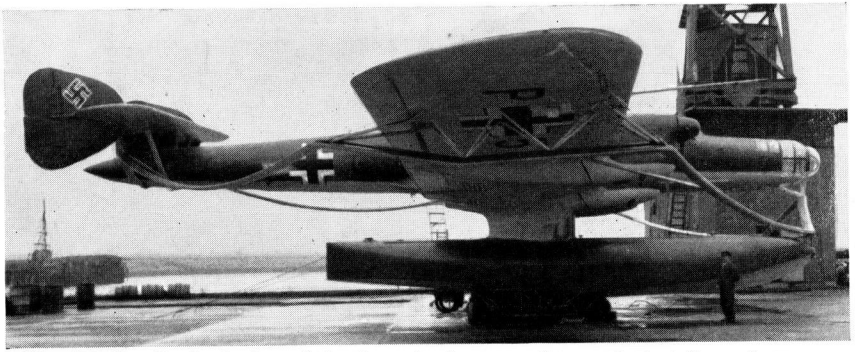




(Left) The third prototype, the Ha 139V3 Nordstern, and (below) the Ha 139V2 Nordwind.

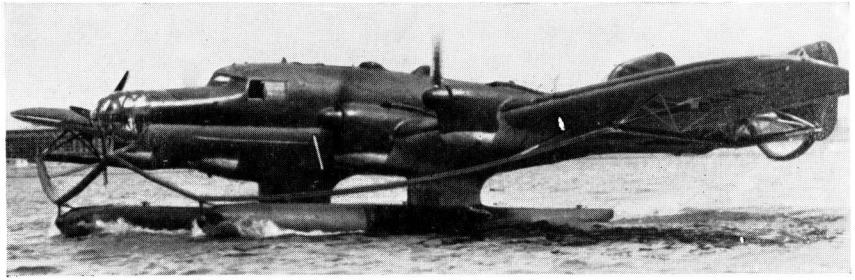


Ha 139V2 went into service on the regular South Atlantic mail service between Bathurst, Gambia, and Natal, Brazil, and by June 1939 the Ha 139s had completed one hundred trans-Atlantic flights, sixty of which were across the South Atlantic. Twenty-six of the flights across the North Atlantic had been made by the improved third prototype, the Ha 139V3 *Nordstern* (D-ASTA) which, delivered to Lufthansa in 1938, featured increased overall dimensions and weights. The Ha 139V3 also embodied a number of aerodynamic refinements, the float stubs being appreciably reduced in size and the engines being lowered in relation to the wing. The first two prototypes were referred to by Lufthansa by the designation Ha 139A and the third machine as the Ha 139B. Early in the development of the Ha 139 a maritime reconnaissance-bomber variant was proposed under the project designation P.20, but this was abandoned at an early design stage.



Shortly after the beginning of the Second World War, the three Ha 139s were commandeered by the Luftwaffe, together with their Lufthansa crews, and the third aircraft was modified for the maritime reconnaissance role as the Ha 139V3/U1. The fuselage nose was extended and extensively glazed for the observer, the vertical tail surfaces were enlarged, and a most unusual magnetic degaussing structure was looped from the fuselage nose to the float tips and from there to the outer wing panels and, finally, the tailplane. This was energised by an auxiliary motor in the fuselage to set up a magnetic field

(*Above and below*) *The Ha* 139*V*3/*U*1 *was originally the Nordstern which flew commercially over the North Atlantic before the war.*

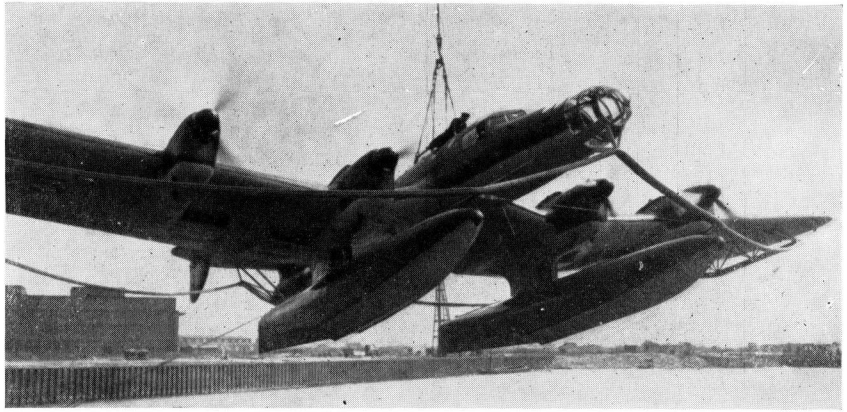


for the sweeping of magnetic mines. The first flight after conversion was carried out on January 19, 1940, after a catapult take-off from the *Friesland* in the Baltic, the crew comprising Oberleutnant Graf Schack and Flugkapitän Schuster from the Travemünde test centre. The loaded weight of the Ha 139V3/U1 was 41,888 lb., and the de-gaussing structure reduced cruising speed by 20 m.p.h. Normal endurance and cruising range were 19.3 hours and 2,858 miles at 148 m.p.h. respectively, and maximum endurance and range were 24.8 hours and 3,075 miles at 124 m.p.h.

During the early stages of the Norwegian campaign, all three Ha 139s were pressed into service as transports, landing troops and freight in the Norwegian fjords, but shortage of spares limited their service with the Luftwaffe.

The following specification relates to the Ha 139A (V1 and V2), figures in parenthesis relating to the Ha 139B (V3).

Type: *Four-seat Long-range Transport Twin-float Seaplane.* **Power Plants:** *Four* 600 *h.p. Junkers Jumo* 205*C twelve-cylinder vertically-opposed Diesel engines.* **Performance:** *Maximum speed,* 196 (202) *m.p.h.; normal cruising speed,* 161 (168) *m.p.h.; economical cruising speed,* 140 (148) *m.p.h.; climb to* 3,280 *ft.,* 6 (4.8) *min.; service ceiling,* 11,480 (18,050) *ft.; maximum range,* 3,290 (3,660) *mls.* **Weights:** *Empty,* 22,840 (24,118) *lb.; loaded,* 37,412 (38,691) *lb.* **Dimensions:** *Span,* 88 *ft.* 7 *in.* (96 *ft.* $9\frac{3}{8}$ *in.*)*; length,* 63 *ft.* $11\frac{3}{4}$ *in.* (64 *ft.* $5\frac{5}{8}$ *in.*)*; height,* 14 *ft.* $9\frac{1}{8}$ *in.* (15 *ft.* 9 *in.*)*; wing area,* 1,259.37 (1,399.31) *sq. ft.*



DORNIER DO 22

GERMANY

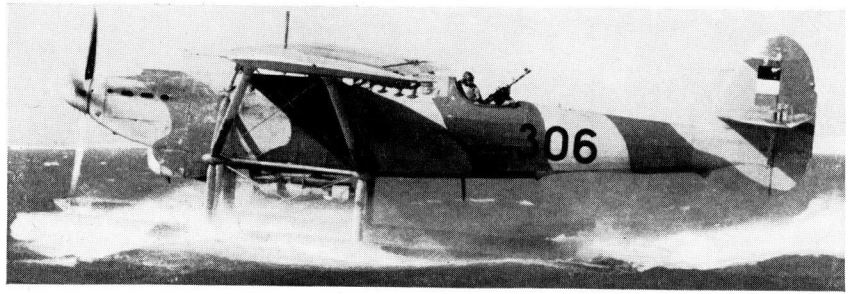
The Do 22 three-seat observation, bombing and torpedo-carrying floatplane was originally developed in 1934 by the Swiss subsidiary of the Dornier-Werke at Altenrhein where the two prototypes were built. Production machines were manufactured at Friedrichshafen although some components were manufactured at Altenrhein. The Do 22 was not ordered by the Luftwaffe, but production to fulfil export orders from Latvia, Greece and Yugoslavia began in 1938. With floats the aircraft was known as the Do 22/See, the first production aircraft of this type flying on July 15, 1938, and with a fixed wheel undercarriage it was designated Do 22/Land, this version flying on March 10, 1939.

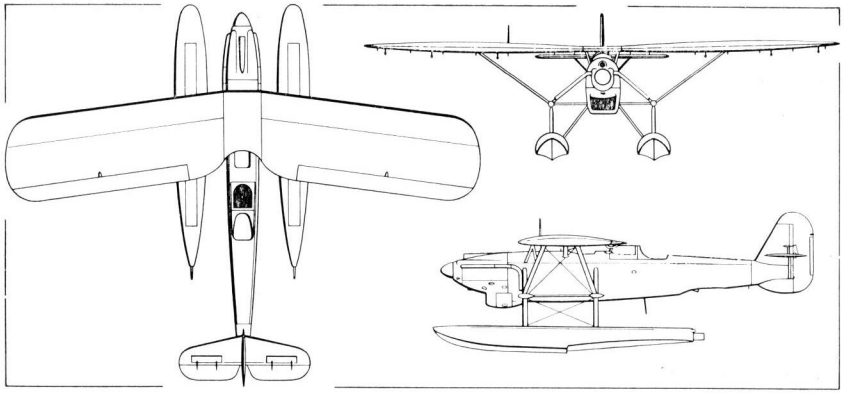
The Do 22 was of all-metal construction with fabric covering, and armament normally comprised four 7.9-mm. machine guns, one being mounted between the cylinder banks and firing through the airscrew hub, two being mounted on a Scarff ring in the rear cockpit, and the other firing through a tunnel below the fuselage. A single torpedo or equivalent loads of bombs could be carried on racks beneath the fuselage. Twelve Do 22Kg floatplanes were delivered to Greece to equip a naval co-operation squadron, twelve Do 22Kj floatplanes were supplied to the Royal Yugoslav Naval Air Service, and the few floatplanes of this type purchased by Latvia were designated Do 22Kl.

Four of the Yugoslav Do 22Kj floatplanes escaped from Yugoslavia to Egypt in April 1941 and continued operations with the Allied forces in the Mediterranean. Four other aircraft captured by the German forces in Greece or Yugoslavia were transferred to the Finnish Air Force in 1942, and were operated by that service both on floats and skis for the remainder of the war.

Type: *Three-seat Reconnaissance-bomber and Torpedo-carrying Float Seaplane.* **Power Plant:** *One* 860 *h.p. Hispano-Suiza* 12*Ybrs twelve-cylinder Vee liquid-cooled engine.* **Armament:** *Four* 7.9-*mm. machine guns and one torpedo or equivalent bomb load.* **Performance:** *Maximum speed,* 217 *m.p.h. at* 13,120 *ft.; cruising speed,* 186 *m.p.h. at* 13,120 *ft.; climb to* 16,400 *ft.,* 13 *min.; ceiling,* 30,176 *ft.; maximum range,* 1,430 *mls.* **Weights:** *Empty,* 5,610 *lb.; loaded,* 8,800 *lb.* **Dimensions:** *Span,* 53 *ft.* 2 *in.; length,* 43 *ft.* 0 *in.; height,* 15 *ft.* 10 *in.; wing area,* 484.2 *sq. ft.*

One of the twelve Do 22*Kj floatplanes supplied to the Yugoslav Navy, and (right) one of four subsequently used by Finland.*

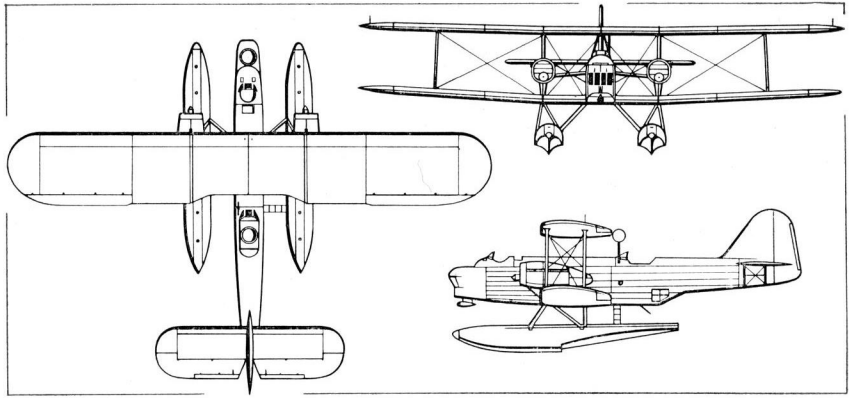




HEINKEL HE 59 GERMANY

Designed in 1930 as a torpedo-bomber and reconnaissance aircraft for use by the still-clandestine Luftwaffe, the He 59 was a large twin-engined biplane of mixed construction suitable for use with both wheel and float undercarriages. The first prototype, which bore the civil registration D-2214, was completed as a floatplane and flown in the January of 1932. This aircraft was, in fact, preceded by the second prototype (D-2215) which, built as a landplane with a fixed trousered undercarriage, flew in September 1931. Production began in the spring of 1932 with a series of fourteen He 59A floatplanes which were essentially similar to the first prototype and

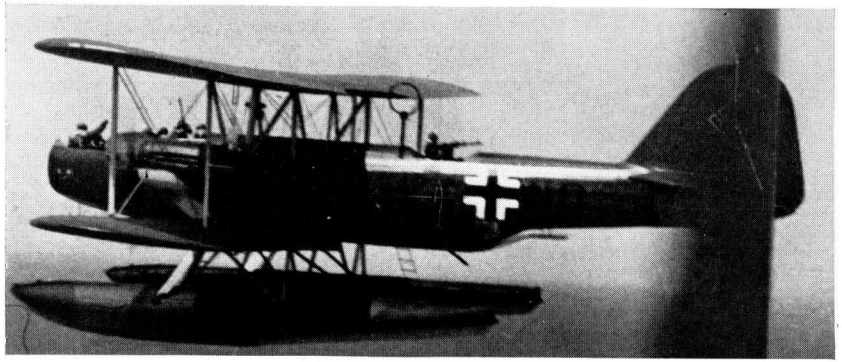
(Above) The second prototype He 59 and (below) an He 59B-2 air-sea rescue floatplane.



were used for evaluation purposes. These were followed by a further sixteen aircraft designated He 59B and differing solely in internal equipment. Both the He 59A and 59B featured an angular nose with plywood skinning, and no armament was provided, but the true pre-production military model, the He 59B-1 (retroactively referred to as the He 59B-0), had a rudimentary open gun position cut in the extreme fuselage nose with a single 7.9-mm. machine gun on a ring-type mounting.

Successful operational trials resulted in substantial production orders for the He 59B-2, the first model to feature dorsal and ventral guns in addition to the nose gun. The nose section introduced on the He 59B-2 was of all metal construction and was extended forward with glazed panels for bomb-aiming. Windows were introduced in the ventral "step" to improve the field of view of the ventral gunner, and all fuel for the BMW VI 6.0 ZU engines was housed within the floats which had a total fuel capacity of 594 Imp. gal. Such was the importance of the He 59B-2 floatplane to the new Luftwaffe that a manufacturing licence was acquired by the Arado Flugzeugwerke which produced the type in parallel with Heinkel.

The He 59B-2 made its operational début over Spain with the Condor Legion at the end of 1936. It was employed primarily as a night bomber and caused havoc in Republican harbours. The pilots of the He 59B-2 floatplanes evolved the technique of cutting their engines while still some distance from their target and then gliding to their destination and taking the anti-aircraft defences by surprise. Some He 59B-2s operated over Spain were fitted with a swivelling 20-mm. MG FF cannon in a reinforced nose position for anti-



(*Above*) *An He 59N radio and navigational training floatplane converted from the He 59D.*

shipping duties. The He 59B-3 was essentially similar to the B-2 but equipped for long-range reconnaissance, defensive armament being reduced to two 7.9-mm. guns and auxiliary fuel tanks being installed in the fuselage. The first He 59B-3 was built by Heinkel but subsequent aircraft of this type were manufactured by Bachmann-Flugzeugbau of Ribnitz.

The next model, the He 59C-1, had a more rotund, "solid" nose with gun position and bomb-aiming facilities deleted, and was intended for both long-range reconnaissance and training duties, while the He 59C-2 was built for air-sea rescue duties, increased radio equipment being installed, all armament being deleted and provision made for six inflatable dinghies. The ventral gun position was replaced by a pick-up hatch. The He 59D was similar to the last-mentioned type but was also intended for training of pilots, navigators and radio operators, and the He 59E-1 was intended for use as a torpedo-dropping trainer. The He 59E-2, only six examples of which were built, carried three cameras for photo-reconnaissance and remained in service until 1941, and the He 59N was a conversion of the He 59D with special radio equipment for navigational training.

A number of He 59s were used for experimental work, one of these, an Arado-built He 59B-2, was fitted with the complete nose section of the He 115V1 in 1937 for tests prior to the completion of the newer floatplane. During the early months of the war, Luftwaffe He 59s laid mines in the Thames Estuary at night, while others were used to control neutral shipping in the Baltic and the North Sea. One of the most notable yet least known operations in which the He 59 participated

was the capture of the main bridge of Rotterdam carried out by sixty airborne troops landed on the river by ten of the Heinkel floatplanes. The He 59C-2 remained in service with the Luftwaffe's air-sea rescue service until finally supplanted by the Do 18 and Do 24 flying boats in 1943. They were extremely active in the Channel during the "Battle of Britain" and flew unmolested until it was discovered that they were using their long-range radio equipment to direct formations of dive bombers to coastal targets, and were also engaged in shadowing convoys.

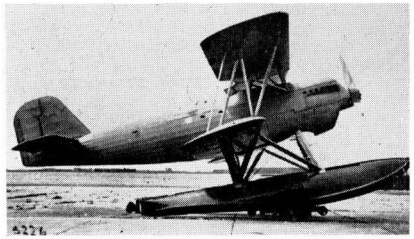
Type: *Four-seat Torpedo-bomber and Reconnaissance, Navigational Training and Air-sea Rescue Twin-float Seaplane.* **Power Plants:** *Two* 660 *h.p. BMW V*1 6.0 *ZU twelve-cylinder Vee liquid-cooled engine.* **Armament:** *One* 7.9-*mm. MG* 15 *machine gun in each of nose, dorsal and ventral positions plus one torpedo or a* 2,200-*lb. bomb load.* **Performance:** *Maximum speed,* 137 *m.p.h. at sea level; maximum cruising speed,* 133 *m.p.h.; initial climb rate,* 738 *ft./min.; time to* 3,280 *ft.,* 4.8 *min.; service ceiling,* 11,480 *ft.; maximum range,* 1,087 *mls.* **Weights:** *Empty,* 13,702 *lb.; loaded,* 19,842 *lb.* **Dimensions:** *Span,* 77 *ft.* 9 *in.; length,* 57 *ft.* 1 *in.; height,* 23 *ft.* 3½ *in.; wing area,* 1,649 *sq. ft.*

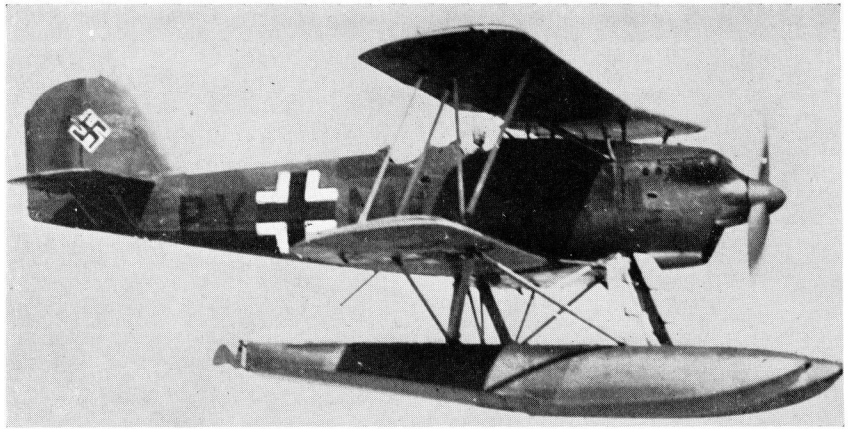
HEINKEL HE 60 — GERMANY

Evolved late in 1932 to meet the requirements of a specification for a shipboard reconnaissance aircraft prepared by the Reichsverkehrsministerium, the ministry responsible for aircraft development in Germany prior to the establishment of the RLM, the He 60 was flown for the first time early in 1933, by which time preparations for quantity production for the German Navy had already begun.

The first prototype, the He 60V1 (D-2325), was not equipped with catapult points, and was powered by a 660-h.p. BMW VI 6.0 ZU liquid-cooled engine, but before initial trials began it was becoming obvious that the floatplane would be under-powered in maximum loaded condition, and therefore the second airframe was fitted with an uprated BMW VI engine offering 750 h.p. for take-off. However, the more powerful engine suffered a number of shortcomings, and as its effect on performance proved to be marginal, it was decided to retain the lower powered engine for the initial production series. The He 60V3 (D-IROL) was the first prototype to be used for catapult launching trials, subsequently being delivered

The Heinkel He 60*V*1 *which flew in* 1933.



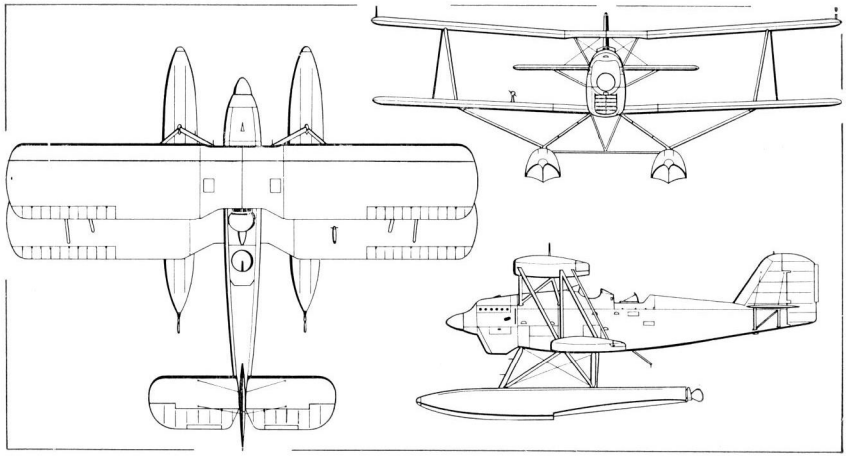


The He 60*C*-1 *was largely relegated to the training rôle by the early months of* 1940.

to the German Navy as the first fully operational specimen of the floatplane, and the He 60V4 (D-IHOH) was also the first He 60A production aircraft, the last-mentioned machine commencing trials in April 1933, together with the second A-series aircraft (D-IVIX). Twelve further A-series floatplanes had been completed by the end of June 1933, and these were delivered to Naval Flying Schools.

During 1934, attempts were made to improve the useful load and performance of the floatplane by installing a substantially more powerful engine. The engine attachment points of the He 60 had been designed to take several types of air-cooled or liquid-cooled engines, but owing to the robust construction of the floatplane necessitated by the rough water requirements of the specification, the useful load of the He 60 with the original engine was extremely small. One He 60 (D-IPZI) was, therefore, fitted with a Daimler-Benz DB 600 engine as a prototype for the proposed He 60B-3 series. With this power plant, rated at 1,000 h.p. for take-off, maximum speed was raised to 177 m.p.h. at sea level, but further development of the He 60B-3 was abandoned owing to the non-availability of the Daimler-Benz engine, and, instead, production continued with the He 60B-2, an improved version of the A-series retaining the original BMW VI engine. A two-seater, the He 60B-2 was normally flown without defensive armament, although a single 7.9-mm. MG 15 machine gun could be mounted in the observer's cockpit.

A reworked and improved version of the basic design and the final production model, the He 60C, was already being delivered to the

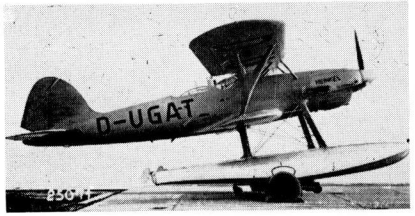


German Navy in 1934, the prototypes of this variant being registered D-ILRO and D-IXES. Delivered to virtually every Naval Flying School and carried by the catapults of all German cruisers, the He 60C was used operationally for the first time during the Spanish Civil War, six forming part of the equipment of a seaplane squadron formed for coastal reconnaissance. In 1939, the He 60C began to give place to the later He 114 and Arado Ar 196 aboard German warships, although a number of the biplanes were still operational with Germany's small Fleet Air Arm, the Seeluftstreitkräfte, at the beginning of the Second World War, operating primarily from coastal bases. It was rapidly relegated to the coastal communications and training roles, however, serving in these roles until 1941–42.

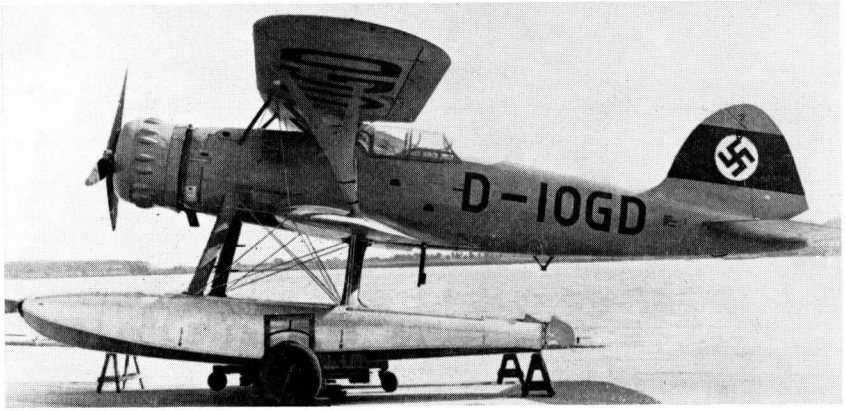
Type: *Two-seat Shipboard Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 660 *h.p. BMW VI* 6.0 *ZU twelve-cylinder Vee liquid-cooled engine.* **Armament:** *One* 7.9-*mm. MG* 15 *machine gun in dorsal position.* **Performance:** *Maximum speed,* 149 *m.p.h. at sea level,* 146 *m.p.h. at* 3,280 *ft.,* 137 *m.p.h. at* 6,560 *ft.; cruising speed* (90 *per cent power*), 134 *m.p.h. at sea level,* 121 *m.p.h. at* 6,560 *ft.; Range* (*full throttle*), 385 *mls. at sea level,* 447 *mls. at* 6,560 *ft.* (*at* 90 *per cent power*), 447 *mls. at sea level,* 513 *mls. at* 6,560 *ft.; time to* 3,280 *ft.,* 3.2 *min., to* 6,560 *ft.,* 8.2 *min.; service ceiling,* 16,400 *ft.* **Weights:** *Empty,* 6,018 *lb.; Loaded,* 7,495 *lb.* **Dimensions:** *Span,* 44 *ft.* $3\frac{3}{4}$ *in.; length,* 37 *ft.* $8\frac{3}{4}$ *in.; height,* 17 *ft.* $4\frac{3}{4}$ *in.; wing area,* 602.784 *sq. ft.*

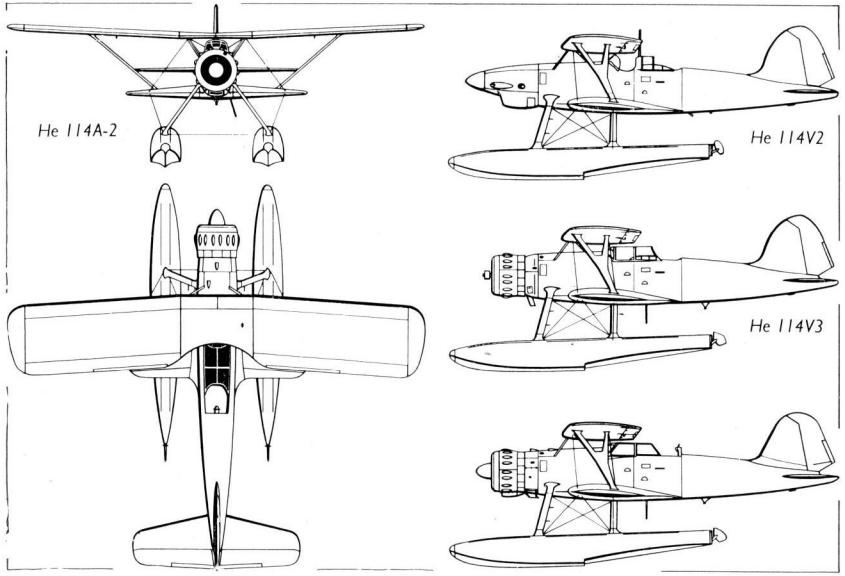
Although the He 114 two-seat reconnaissance floatplane was designed primarily for catapult operation from surface vessels of the *Deutsche Kriegsmarine*, succeeding the He 60 biplane, it was destined to operate almost exclusively from coastal seaplane stations, and during the war years it operated over the Channel, the North Sea, the Adriatic, the Mediterranean and the Black Sea, although its activities were largely confined to areas in which it was unlikely to encounter Allied fighters.

Developed in parallel with the twin-engined He 115 floatplane, the He 114 was a sesquiplane of mixed construction. The wings were primarily of wood, the upper wing being carried above the fuselage by splayed N-struts and braced to the lower stub wings by sloping Y-struts, the fuselage was a metal monocoque, and the single-step floats were constructed of hydronalium. The first prototype, the He 114V1, was powered by a Daimler-Benz DB 600 twelve-cylinder inverted-Vee liquid-cooled



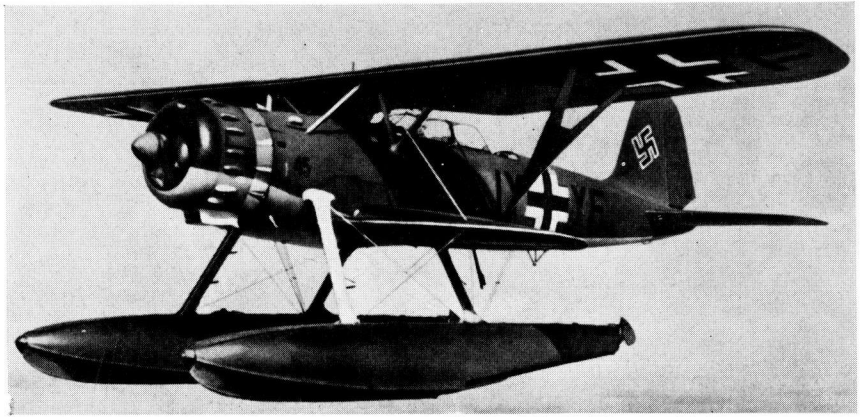
(Left) The He 114*V*2 *and (below) the He* 114*V*3.

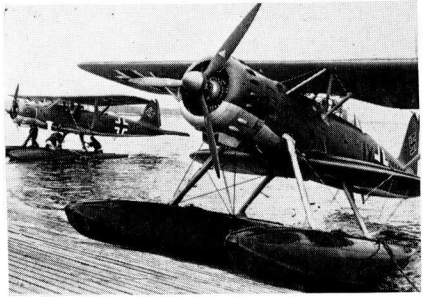




engine which drove a two-blade airscrew, and flew for the first time in 1936. Flown shortly after the first machine, the He 114V2 (D-UGAT) differed in having a Junkers Jumo 210 engine driving a three-blade airscrew, while the He 114V3 (D-IOGD) and V4 (D-IDWS) had BMW 132Dc and 132K air-cooled radials driving two- and three-blade airscrews respectively. The last-mentioned prototype featured floats of modified design which were intended to throw the water spray clear of the aircraft during take-off and landing. These proved unsuccessful, however, as the floatplane proved unstable while running on the water, tending to swerve violently, and the He 114V4 was re-equipped with floats similar to those of its predecessors.

The He 114V5 powered by the BMW 132Dc was intended as the production prototype, and a pre-production series of ten similar He 114A-0 floatplanes were built, four of these receiving *Versuch* numbers V6 to V9 inclusive for further development purposes. One of these, the He 114V8 (D-IDEG) differed from





The He 114A-2 (above and left) was not a very successful floatplane and was built in relatively small numbers.

earlier machines in having the catapult points deleted, serving as the prototype for the He 114A-1 production model, and another, the He 114V9 (D-IHDG) served as the prototype for the He 114A-2.

Thirty-three He 114A-1 floatplanes were built and used exclusively for training, twenty of these having two-blade airscrews and the remainder three-bladers. Some were equipped with catapult points. The He 114A-2 which entered production in 1938 was the first operational version, differing from the A-1 in having the 880 h.p. BMW 132Dc supplanted by the 970 h.p. BMW 132K driving a three-blade airscrew, and catapult points as standard. An export version of the He 114A-2 was produced as the He 114B-1, and fourteen aircraft of this type were exported to Sweden in 1939. The Danish government also placed an order for four aircraft of this type on April 1, 1940, for delivery in July-August of that

year, but the contract was, of course, cancelled after the occupation of Denmark by German forces. Six aircraft were produced for export to Rumania under the designation He 114B-2, three of these being powered by Junkers Jumo 210 engines driving two-blade airscrews and three were powered by Daimler-Benz DB 600 engines driving three-blade airscrews, and a further twelve machines exported to Rumania as He 114B-3s were BMW 132K-powered He 114A-2s.

Production terminated in 1939 with a batch of fourteen He 114C-1s for the Luftwaffe, these being identical to the A-2 model apart from modified equipment and the installation of a second fixed forward-firing 7.9-mm. MG 17 machine gun. The He 114C-2 was an unarmed conversion of the A-2, four of which were built in 1939 to operate from the catapults of ships in the South Atlantic and the Pacific serving as commerce raiders. Although already approaching obsolescence at the beginning of the Second World War, the He 114 saw considerable service, and both German and Rumanian floatplanes of this type were active against Russian shipping in the Black Sea.

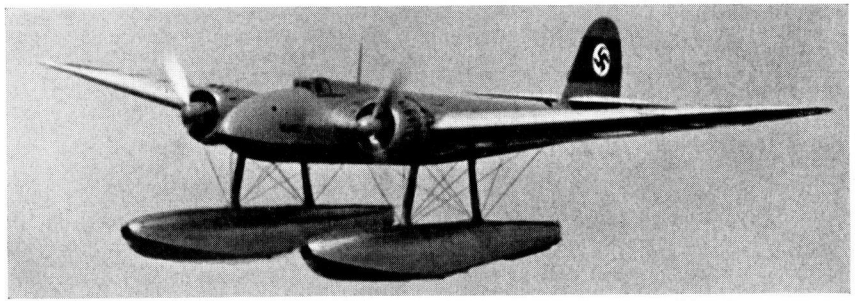
The following specification relates to the He 114A-2.

Type: *Two-seat Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 970 *h.p. BMW* 132*K nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 7.9-*mm. MG* 17 *machine gun and one* 7.9-*mm. MG* 15 *gun on flexible mount in observer's cockpit plus two* 110-*lb. SC* 50 *bombs.* **Performance:** *Maximum speed,* 208 *m.p.h. at* 11,550 *ft.; maximum cruising speed,* 181 *m.p.h.; economical cruising speed,* 165 *m.p.h.; climb to* 6,560 *ft.,* 6.5 *min., to* 13,120 *ft.,* 14 *min.; service ceiling,* 15.750 *ft.; range (with* 141 *Imp. gal.),* 652 *mls.* **Weights:** *Empty,* 5,101 *lb.; loaded,* 7,672 *lb.* **Dimensions:** *Span,* 44 *ft.* 7½ *in.; length,* 36 *ft.* 4½ *in.; height,* 16 *ft.,* 10¾ *in.; wing area,* 455.313 *sq. ft.*

HEINKEL HE 115 — GERMANY

One of the best float seaplanes used by any of the combatants during the Second World War was the He 115 developed in the mid 'thirties by the Ernst Heinkel A.G. Possessing exceptionally fine water handling qualities, good stability even at extremely low speeds, and a respectable performance, the He 115 was the Luftwaffe's most important torpedo-bomber and reconnaissance floatplane. It was largely responsible for laying the magnetic mines which, at one period of the war, caused so much damage to Allied shipping, and it served over the Atlantic, the Baltic, the Mediterranean, and the North Sea.

An all-metal mid-wing monoplane with a monocoque fuselage and a two-spar wing built in three sections, the first prototype, the He 115V1 registered D-AEHF, was powered by two BMW 132K nine-cylinder radial air-cooled engines rated at 960 h.p. for take-off and 690 h.p. at 5,900 ft., and carried a defensive armament of two 7.9-mm. MG 15 machine guns, one of which was mounted in a ball-type nose housing which had been first tested on an Arado-built He 59B-2. The twin single-step all-metal floats were mounted directly beneath the engine nacelles by parallel pairs of near-vertical struts with wire cross-bracing, and after initial trials, the He 115V1, like so many other Heinkel aircraft, was modified for record-breaking purposes, a streamlined wooden nose cone supplanting the

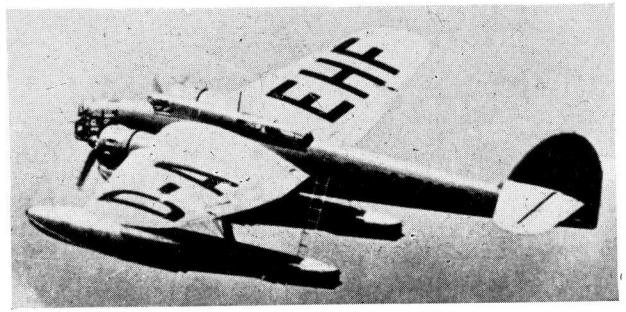


(Above) The He 115V1 (D-AEHF) seen in its cleaned-up form for record-breaking purposes.

original angular nose with its gun position and bomb-aiming panels, the stepped observer's position being faired over and emergency auxiliary controls being mounted in the wireless-operator's compartment. In this form, on March 20, 1938, the He 115V1 gained eight speed records for aircraft of its category by covering 1,000 and 2,000-km. courses with payloads of 1,100, 2,200 and 4,400 lb. at an average speed of 204 m.p.h.

A second prototype, the He 115V2 registered D-APDS, featuring a slightly modified nose section had flown shortly after the He 115V1 in 1936, and was soon followed by a third machine, the He 115V3 (D-ABZV), with an entirely redesigned nose section and a continuous "glasshouse" type canopy extending from the pilot's position to that of the dorsal gunner-observer, these changes being retained for subsequent production aircraft. The He 115V4 (D-AHME), or production prototype, dispensed with the series of bracing wires between the floats and the fuselage and wings

(Below) The He 115V1 as originally flown with angular glazed nose.

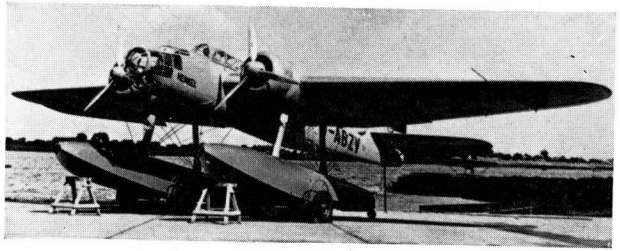


in favour of more extensive strut bracing, the floats being attached to the engine nacelles by vertical N-struts and to the fuselage by parallel sloping struts.

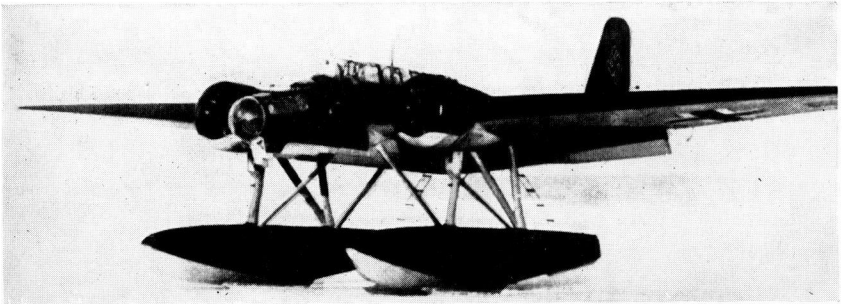
A batch of ten pre-production He 115A-O floatplanes was completed in 1937, this model having empty and loaded weights of 11,927 lb. and 20,723 lb. respectively, maximum bomb load being 2,756 lb. Sole defensive armament comprised one 7.9-mm. MG 15 machine gun for the observer, and performance included maximum speed of 195 m.p.h. at 11,150 ft., a maximum cruising speed of 189 m.p.h. at the same altitude, a range of 1,243 miles and a service ceiling of 14,110 ft. In the following year, thirty-four He 115A-1 aircraft were delivered, these differing from the pre-production model solely in having a 7.9-mm. MG 15 gun in the extreme nose. This model was also offered for export as the He 115A-2, and was chosen for the Norwegian Naval Air Service in the spring of 1938, a contract for six aircraft being signed on August 28, 1938, these eventually being delivered to Norway during the summer and autumn of 1939. The Swedish government also selected the He 115A-2 as its standard reconnaissance and torpedo-bomber floatplane, placing an order for ten aircraft.

The first variant to be built in relatively large numbers was the He 115A-3 which featured a redesigned bomb-bay and later radio equipment, but by the end of 1938, the Luftwaffe was demanding a greater operational range, resulting in the appearance of the He 115B-0 with increased fuel capacity which enabled a maximum range of 2,080 miles to be attained. Empty weight rose to 14,748 lb., and maximum overload weight was 22,928 lb. The production He 115B-1 was essentially similar to the ten pre-production floatplanes, and fifty-two He 115B-1s and B-2s were delivered during 1939. Some He 115B-1s were adapted to carry a 2,028-lb. magnetic mine in addition to a 1,100-lb. bomb load with which loaded weight rose to 23,843 lb. and maximum range was reduced to 1,616 miles. The He 115B-2 differed primarily in having reinforced floats which permitted it to operate from ice and snow, this version being produced for both the reconnaissance and the reconnaissance-bomber roles.

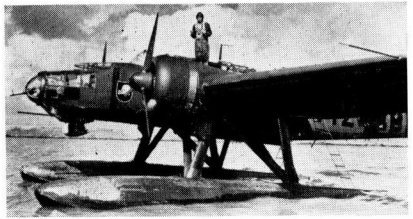
When German forces invaded Norway on April 9, 1940, the Norwegian Naval Air Service had reached the conclusion that the defensive armament of its He 115A-2 floatplanes, which comprised two 0.303-in. Browning machine guns, was inadequate, and a 20-mm. Oerlikon cannon was in process of being installed in the nose of each aircraft. No cannon installation had been completed, however, when fighting began. Three He 115A-2s were based in Southern Norway with No. 2



The He 115V3 was the last prototype to employ float bracing wires.



(Above) The He 115B-2 with specially strengthened floats and (left) the He 115C-1 with 20-mm. nose cannon.

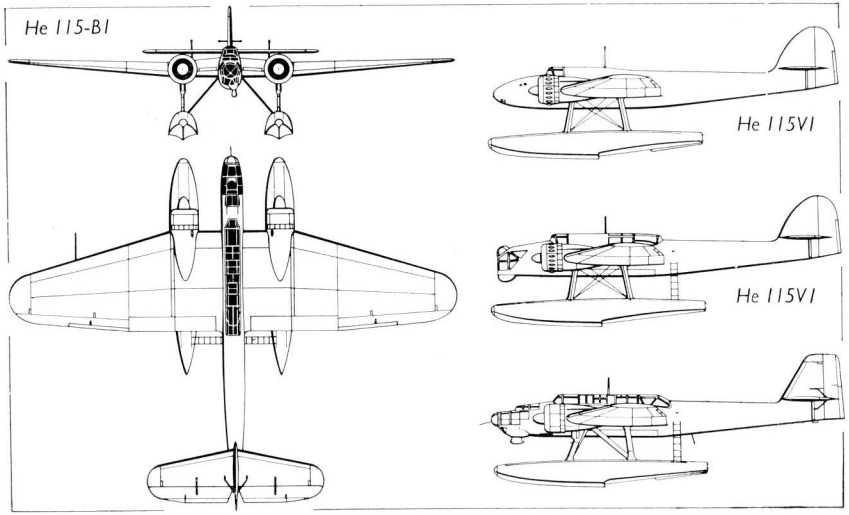


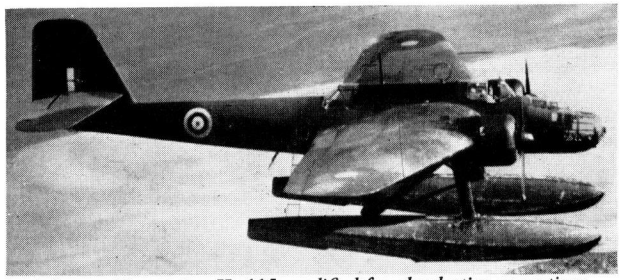
Squadron and the other three were operated in Northern Norway with No. 3 Squadron. One of the former unit's aircraft was captured by German forces in Hafrsfjord during the occupation of Stavanger, and with the evacuation of Southern Norway, one was flown to Scotland and the other was flown North to join No. 3 Squadron which had been reinforced by two He 115B-1s which had been captured intact from the Luftwaffe, these having landed at Brønnøysund and Ørnes respectively. These He 115B-1s were fully operational with bombs, ammunition, and an improved Goertz bomb-sight, and at the beginning of May, these together with the four He 115A-2s, operated over the Narvik area, making a number of bombing attacks on German positions North of Læigastind and Gratangseidet. The last sortie by the floatplanes was made against the German headquarters three miles South of Bjørnefjell shortly before the ceasefire of June 7.

At this time, one of the ex-Luftwaffe He 115B-1s was no longer airworthy and, after being cannibalised for spares, was left a Skattøra. One of the He 115A-2s which was barely airworthy was flown to Finland where it was interned, and the remaining three He 115A-2s and one He 115B-1 were flown to the Shetlands. One of the He 115A-2s ran out of fuel just short of its destination and was sunk by its own crew, but the remaining three aircraft were eventually flown to the M.A.E.E. at Helensburgh on the Clyde, and, with the machine flown to the United Kingdom earlier, received the serial numbers BV184-7. Two of

the He 115s were destroyed in crashes while under test, and the remaining two were modified to undertake clandestine missions. Defensive armament was increased by the installation of eight machine guns in the wings, four of these firing aft and controlled by the pilot by means of a special rear-view sight, and the glazed panels were removed from most of the long "glasshouse" enclosure. Flown by Lieut. Offerdahl, one of the He 115s left for Malta in the spring of 1941, the task of the aircraft being the transportation of agents between the island and enemy territory in North Africa. The He 115 invariably operated at night and on occasions sported Luftwaffe insignia, but it was finally destroyed when the hangar in which it was housed on Malta received a direct hit from a German bomb. The second converted He 115 was flown on clandestine operations from Woodhaven, near Dundee, by Lieut. Skavhaugen, but too many risks were entailed in operating a typical Luftwaffe aircraft in the vicinity of the United Kingdom, so the venture was abandoned, the aircraft remaining moored in the Tay until, late in 1943, it was broken up.

Trials with the He 115B-1 at Helensburgh revealed the exceptional qualities of the floatplane, but as fighter opposition around the British coastline increased, the Luftwaffe began





A former Norwegian He 115 modified for clandestine operations.

to realise that the defensive armament of the aircraft was inadequate, and during 1940, the He 115C-0 made its début. In addition to the two hand-held 7.9-mm. MG 15 machine guns, a single 20-mm. MG 151 cannon was mounted beneath the nose and some machines also had a single fixed forward-firing 7.9-mm MG 17 machine gun in each wing root. The He 115C-1, which entered service in 1941, carried a similar armament and had provision for auxiliary fuel tanks in the bomb bay; the He 115C-2 was fitted with reinforced float planing bottoms for operation from snow and ice. The He 115C-3, eighteen examples of which were built, was a specialised mine-laying variant, and the He 115C-4 was a torpedo-bomber in which defensive armament was reduced to one rear-firing MG 15 machine gun, thirty examples being built.

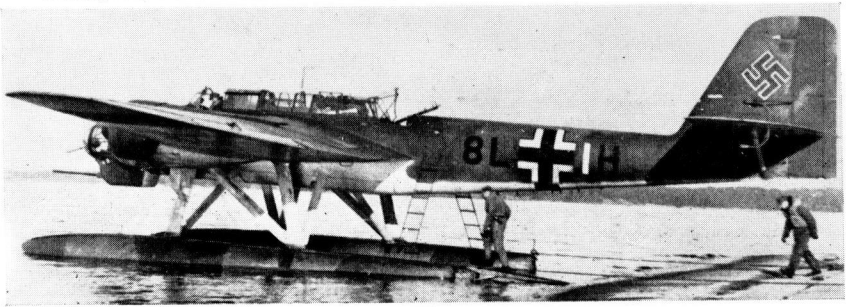
A more powerful multi-purpose development of the floatplane, the He 115D, was proposed by Ernst Heinkel at an early stage. Suitable for the reconnaissance, level bombing, mine-laying, and even shallow dive-bombing roles, it was planned to power this model with two BMW 800 radials, but the discontinuation of the development of this engine resulted in the sole example of the He 115D being fitted with two 1,600 h.p. BMW 801C radials, this aircraft being a conversion of an He 115A-1 airframe. Carrying four crew members, the He 115D had a defensive armament of one 20-mm. cannon and one 7.9-mm. machine gun firing forward, and twin 7.9-mm. machine guns in each of dorsal and ventral positions. Maximum and cruising speeds were 248 m.p.h. and 224 m.p.h. respectively, service ceiling was 23,295 ft., and empty and loaded weights were 17,802 lb. and 26,940 lb. The He 115D was actually employed operationally during 1941.

Seventy-six He 115s had been delivered in 1940, but more urgently needed landplanes subsequently took production priority, and it was not until late in 1943 that the floatplane was reinstated in production, a total of 141 He 115E multi-purpose aircraft being delivered in 1944. The pre-production He 115E-0 and production E-1 were essentially similar to the earlier B- and C-models, but defensive armament normally comprised twin forward-firing hand-operated 7.9-mm. MG 81 machine guns and a pair of similar hand-operated guns firing aft. Some machines also carried a single forward-firing 20-mm. MG 151 cannon.

The following specification relates to the He 115B-1.

Type: *Three-seat Torpedo-bomber, Mine-laying and Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two 970 h.p. BMW 132K nine-cylinder radial air-cooled engines.* **Armament:** *One flexible forward-firing 7.9-mm. MG 15 machine gun and one aft-firing flexible MG 15, plus one 1,760-lb. torpedo and two 550-lb. bombs, one 2,028-lb. mine and two 550-lb. bombs, or five 550-lb. bombs.* **Performance:** *Maximum speed, 186 m.p.h. at sea level, 203 m.p.h. at 11,150 ft.; maximum cruising speed, 185 m.p.h. at 11,150 ft.; time to 2,000 ft., 2.6 min., to 5,000 ft., 6.4 min., to 10,000 ft., 14.4 min.; service ceiling, 17,060 ft.; normal range, 1,300 mls.; maximum range, 2,080 mls.* **Weights:** *Empty, 14,748 lb.; normal loaded, 20,020 lb.; maximum overload, 22,928 lb.* **Dimensions:** *Span, 73 ft. 1 in.; length, 56 ft. 9 in.; height, 21 ft. 7¾ in.; wing area, 933.229 sq. ft.*

A late production He 115C-1 with enlarged cannon housing beneath the extreme nose.

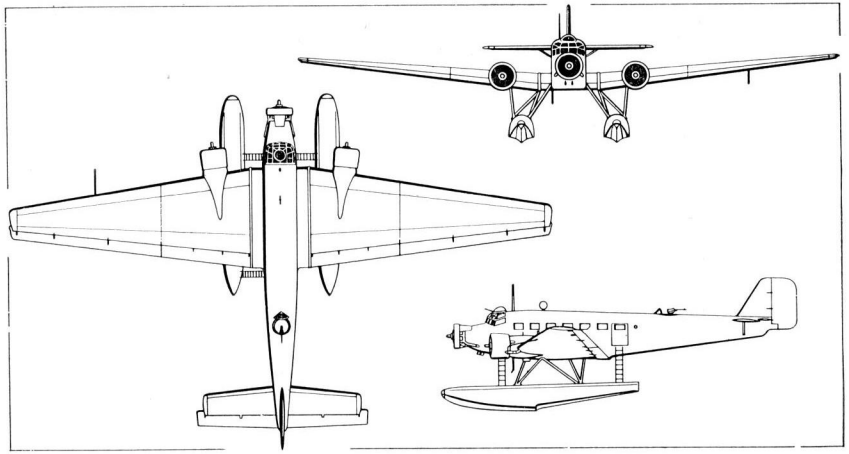


JUNKERS JU 52/3mW

GERMANY

A lumbering, lightly-armed tri-motor with a corrugated metal skin, the ageing Junkers Ju 52/3m played as important a role in the German victories during the first years of the Second World War as any Luftwaffe first-line combat aircraft. This rugged and reliable transport, capable of operating efficiently from small, rough, high-altitude fields or, with floats, from the sheltered waters of fjords and bays, was built in larger numbers than any transport type other than the Douglas C-47, no less than 4,845 being manufactured between 1934 and 1944.

Derived from the Ju 52 which, powered by a single 800 h.p. Junkers L.88 twelve-cylinder liquid-cooled engine, flew for the first time on October 13, 1930, the tri-motor Ju 52/3m appeared eighteen months later with a trio of 575 h.p. BMW 132A radial air-cooled engines and enjoyed instantaneous success, being manufactured in substantial numbers for Deutsche Lufthansa and many foreign airlines. As a heavy bomber the aircraft was also produced for the Luftwaffe as the Ju 52/3m g3e, 450 examples of this variant being manufactured under the 1934-35 aircraft production



programme, but its first operational task was in the role of transport, ferrying Moorish troops from Spanish Morocco to Spain during the Spanish Civil War. The Ju 52/3m g3e was supplanted by the g4e transport in which the ventral gun turret was eliminated, the maximum loaded weight increased from 20,900 lb. to 23,100 lb., and the undercarriage strengthened.

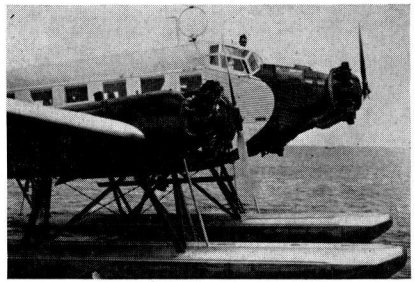
From the occupation of Austria in March 1938, the Ju 52/3m transport played a leading role in every German campaign, and it may be said that, had it not been for the availability of this aircraft in large numbers, the course of the Second World War may well have taken a very different turn. Many of the Ju 52/3m transports supplied to Lufthansa had interchangeable wheel or float undercarriages, and when fitted with twin single-step metal floats the transport was designated Ju 52/3mW. Ju 52/3mW floatplanes taken over from Lufthansa by the German Air Transport Command were used extensively by the Luftwaffe during the invasion of Norway, these aircraft landing with troops and supplies on the fjords while standard machines with wheel undercarriages flew in a steady stream of troops and equipment to consolidate the positions taken by paratroops and by alpine troops landed in the fjords from floatplanes.

The success of the Ju 52/3mW floatplanes in Norway was such that, with the occupation of the Fokker factory in the Netherlands, this plant was set the task of manufacturing sets of floats for the transport, producing these from 1940 until mid-1942 so that standard Ju

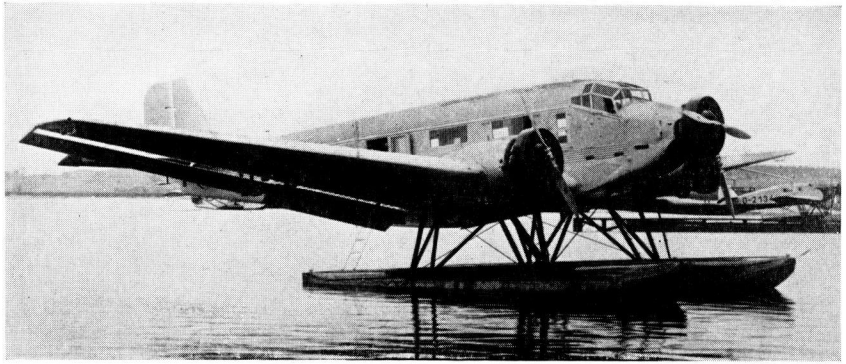
52/3m transports, including the g4e, g5e, g7e, and g8e versions, could be equipped with floats as tactical demands arose. Float-equipped Ju 52/3ms were employed during the invasion of Crete, in the operations against Greece and Yugoslavia, and to supply Rommel's Army with equipment in North Africa.

The following specification relates to the float-equipped version of the Ju 52/3m g7e.

Type: *Twin-float Transport Seaplane.* **Power Plants:** *Three* 830 *h.p. BMW* 132*T nine-cylinder radial air-cooled engines.* **Armament:** *One* 13-*mm. MG* 131 *machine gun in open dorsal position and two lateral* 7.9-*mm. MG* 15 *machine guns.* **Performance:** *Maximum speed,* 158 *m.p.h. at sea level,* 163 *m.p.h. at* 3,000 *ft.; cruising speed,* 129 *m.p.h. at* 3,000 *ft.; climb to* 9,840 *ft.,* 19 *min.; service ceiling,* 16,580 *ft.; maximum range,* 930 *mls. at* 8,200 *ft.* **Weights:** *Empty,* 15,675 *lb.; loaded,* 24,200 *lb.* **Dimensions:** *Span,* 95 *ft.* 10 *in.; length,* 62 *ft.* 4 *in.; height,* 17 *ft.* 9 *in.; wing area,* 1,900 *sq. ft.*



(Below) A standard Ju 52/3*mW and (above, right) an early example with uncowled engines.*



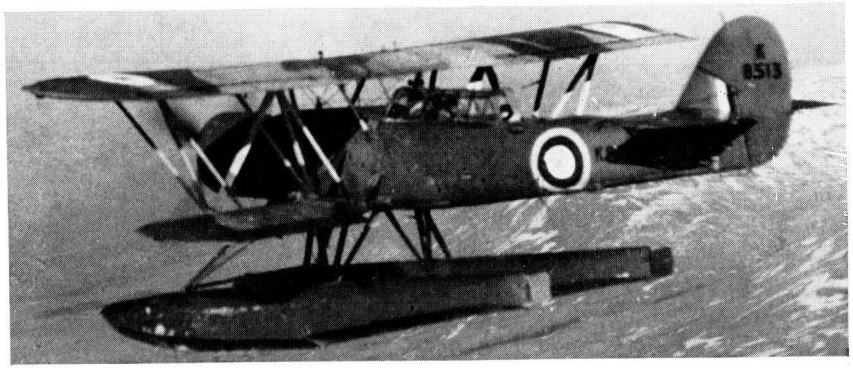
BLACKBURN SHARK

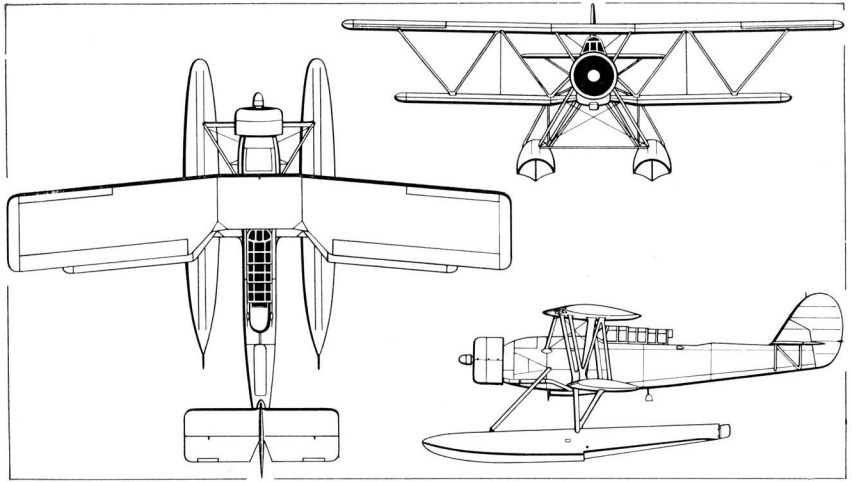
GREAT BRITAIN

Designed as a two/three-seat torpedo-bomber and reconnaissance aircraft for use from either wheels or floats, the Shark flew for the first time in landplane form as the private-venture B-6 of May 1934, this aircraft eventually being allocated the serial number K4295. The Shark featured a watertight all-metal monocoque fuselage, and the unequal-span, all-metal, two-spar wings were braced by inclined N-type interplane struts. The floats were attached to the same fuselage and wing root joints as the wheel undercarriage, two additional attachment points being provided in the forward part of the fuselage. The floats, which embodied shock-absorbing devices at their points of attachment, were of Alclad single-step type and of Blackburn design, and were interchangeable. The water rudders were actuated pneumatically by the same system which actuated the wheel brakes on the landplane version. The Shark I was supplied to the Royal Navy in both floatplane and landplane forms, although the latter predominated, and early in 1936, six Shark floatplanes were supplied to Portugal.

Sixteen Shark Is were followed by 126 Shark IIs, and three first-line squadrons, No. 810 aboard H.M.S. *Courageous*, No. 820 aboard the same carrier, and No. 821 aboard H.M.S. *Furious*, re-equipped with this type, although its service with these units was brief as all three squadrons re-equipped with the Swordfish in 1938. Under a licencing agreement, Boeing Aircraft of Canada Ltd. at

A Shark II (K8513) modified to Mk. III standards with a glazed canopy over the cockpits.





Vancouver manufactured twenty-six Shark IIIs with Bristol Pegasus engines in place of the standard Tiger VIc, these serving with the R.C.A.F. The Shark III was the final production model and introduced the refinement of a glazed canopy for the crew, and built to specification S.19/36, this version was intended primarily for the training of observers and telegraphists, ninety-five being built. From July 1938, a number of Shark IIs were reconditioned and brought up to Mk. III standards, and these were used with both wheel and float undercarriages until 1942 for training and other second-line roles. The Boeing-built Shark IIIs were all supplied with interchangeable wheel, float and ski undercarriages.

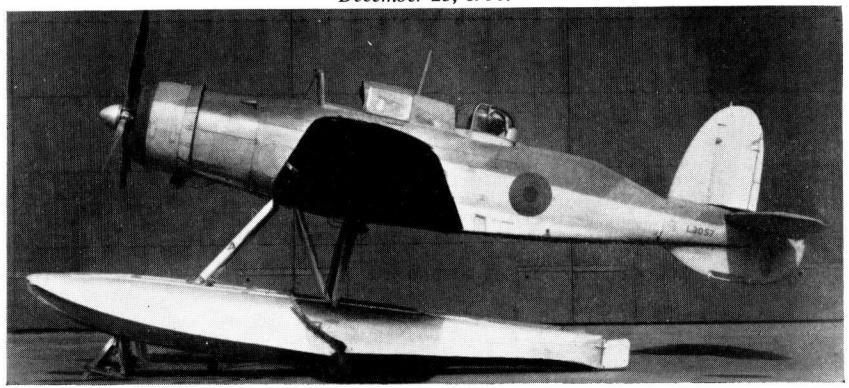
Type: *Three-seat Crew Training Twin-float Seaplane.* **Power Plant:** *One* 746 *h.p. Armstrong Siddeley Tiger VIc fourteen-cylinder radial air-coo ed engine.* **Armament:** *One fixed forward-firing* 0.303-*in. Vickers machine gun and one* 0.303-*in. Vickers gun on flexible mounting, plus one torpedo of* 1,500-*lb. bomb load.* **Performance:** *Maximum speed,* 143 *m.p.h. at* 5,500 *ft.; cruising speed,* 112 *m.p.h.; initial climb rate,* 732 *ft./min.; normal range,* 690 *mls.; maximum range (with* 160 *Imp. gal. auxiliary tank),* 1,140 *mls.; service ceiling,* 15,250 *ft.* **Weights:** *Empty,* 4,785 *lb.; loaded,* 8,250 *lb.* **Dimensions:** *Span,* 46 *ft.* 0 *in.; length,* 38 *ft.* 5 *in.; height,* 15 *ft.* 6 *in.; wing area,* 489 *sq. ft.*

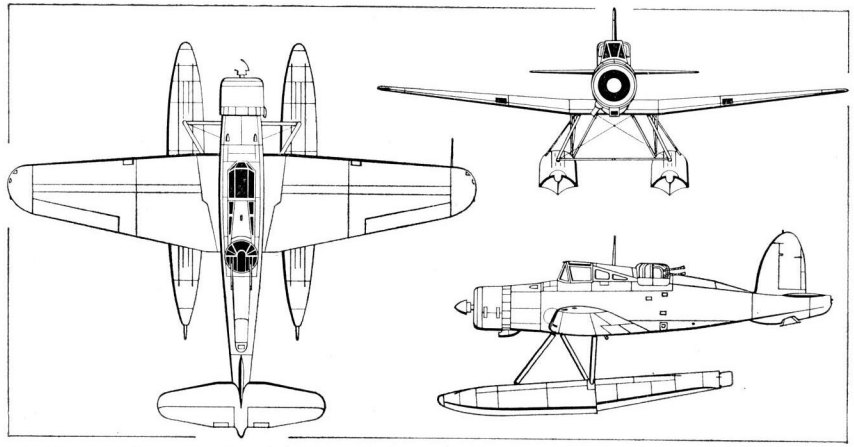
During the late 'thirties, some thought was given to the development of a two-seat float fighter suitable for use from sheltered waters in areas where no suitable airfields were available, and sets of Shark floats were adapted to suit them for application to the Blackburn Roc two-seat shipboard fighter to specification 20/37. A set of these floats was fitted to the third production Roc (L3059) and were of single-step Alclad type incorporating shock-absorbing devices at their points of attachment. The water rudders were operated pneumatically by the system which actuated the wheel brakes on the landplane model, and the bracing struts followed broadly the form taken by those of the Shark, wire bracing being employed only in the front truss.

The Roc floatplane was completed in November 1939, and transported to the Marine Aircraft Experimental Establishment at Helensburgh for handling trials. However, the machine immediately displayed marked directional instability, and crashed just after take-off on December 3, 1939.

As the first prototype floatplane had been lost before any attempt could be made to rectify its instability, it was decided to fit another set of floats to the first production Roc (L3057) which had flown as a landplane for the first time on December 23, 1938. The conversion was completed in March 1940, and during the following month this aircraft was also sent to Helensburgh. It was found that the instability experienced with the first aircraft was still present, and that the Roc floatplane was dangerous if any attempt was made to manoeuvre at low altitude. In straight flight there was a tendency to yaw from side

The second float-equipped Roc (L3057) was actually the first prototype originally flown on December 23, 1938.





to side, and in turns the aircraft tended to sideslip inwards and increase the bank, any attempt to check this with the rudder resulting in the nose dropping and height being lost.

As a means of rectifying the directional instability, a ventral fin was added beneath the tail. This resulted in a marked reduction in instability, but there was still a tendency in turns to overbank, and considerable care was necessary in turns at low altitude. Tests were conducted up to the maximum weight of 8,670 lb., and the taxying qualities of the Roc in winds up to 20 m.p.h. were good, although the take-off run was long, take-off speed being 75 knots and any attempt to pull the floatplane off at lower speeds being unsuccessful.

The Roc floatplane was extensively tested from the River Clyde near Helensburgh and from Loch Lomond, but after the completion of trials by the M.A.E.E., development of this version of the Roc was abandoned as little need for such an operational aircraft had arisen.

Details of the landplane version of the Roc will be found on pages 4-5, Volume II.

Type: *Two-seat Twin-float Fighter Seaplane.* **Power Plant:** *One* 905 *h.p. Bristol Perseus XII nine-cylinder radial air-cooled engine.* **Armament:** *One Boulton Paul "A" power-driven turret containing four* 0.303-*in. Browning machine guns with* 600 *r.p.g.* **Performance:** *Maximum speed,* 178 *m.p.h. at* 6,000 *ft.; cruising speed,* 122 *m.p.h. at* 13,000 *ft.; initial climb rate,* 980 *ft./min.; service ceiling,* 15,000 *ft.; range,* 560 *mls.* **Weights:** *Loaded,* 8,670 *lb.* **Dimensions:** *Span,* 46 *ft.* 0 *in.; length,* 37 *ft.* 6 *in.; height,* 18 *ft.* 0 *in.; wing area,* 310 *sq.ft.*

FAIREY SWORDFISH

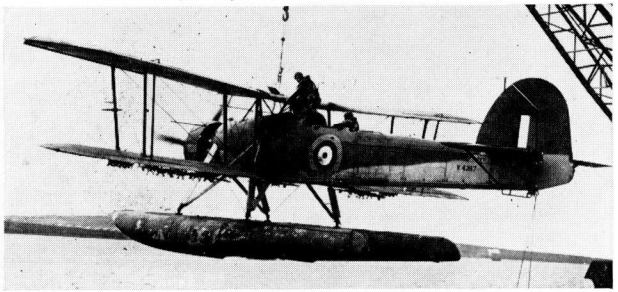
GREAT BRITAIN

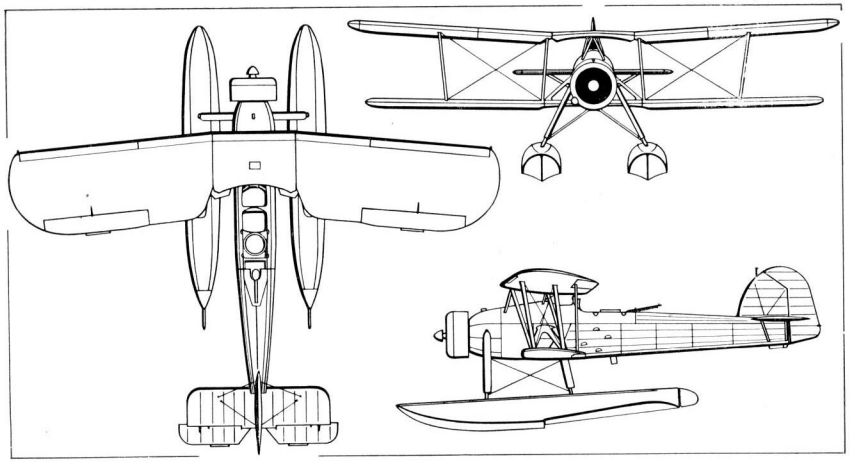
Few aircraft of the Second World War achieved greater fame than the Swordfish. Known affectionately to its crews as the "Stringbag", the Swordfish was without vices, and despite its obsolescence, its achievements were legendary. A simple, sturdy and practical aircraft developed to a well-tried formula, the Swordfish introduced no innovations, and by all normal standards was obsolete before the beginning of the Second World War, yet it remained operational throughout the war years, out-living its intended replacement, the Albacore.

The design of the Swordfish stemmed from the private-venture T.S.R.I which flew for the first time on March 21, 1933. Although this aircraft was lost in an accident six months later, its promise was such that a second prototype, the T.S.R.II incorporating an extra bay in the fuselage and a redesigned tail, was built to conform with specification S.15/33, and powered by a 775 h.p. Bristol Pegasus IIIM.3 which supplanted the 635 h.p. Pegasus IIM, this aircraft flew for the first time on April 17, 1934. The T.S.R. II (K4190) became the prototype of the Swordfish, and three pre-production aircraft and eighty-six production aircraft were ordered in the spring of 1935 to specification S.38/34. This specification demanded interchangeable wheel and float undercarriages, and the third pre-production aircraft (K5662) was completed as a floatplane, but before this aircraft was delivered to the M.A.E.E. at Felixstowe, the T.S.R.II had been fitted with twin Fairey single-step metal floats, flying as a floatplane for the first time on November 10, 1934, from Hamble, and subsequently completing catapult-launching trials aboard H.M.S. *Repulse*.

The Swordfish floatplane equipped Nos. 701, 702 and 705 Catapult Flights, serving aboard battleships and cruisers, No. 700 Squadron which served as a pool for catapult aircraft from January 1940, and from October 1940 to January 1942 by the R.A.F.'s No. 202 Squadron which operated these floatplanes from Gibraltar. The Swordfish floatplane first distinguished itself in April 1940, during the Second Battle of Narvik when an aircraft of this type catapulted from H.M.S. *Warspite* spotted for the guns of the British vessels, resulting in the destruction of the entire force of seven enemy destroyers,

A Swordfish I floatplane from H.M.S. Malaya.





finishing off one of the destroyers itself with bombs, and also sinking a submarine, the U-64! After the action, Vice-Admiral Whitworth wrote of the Swordfish floatplane, "The reports made by *Warspite's* aircraft were invaluable. I doubt if ever a shipborne aircraft has been used to such good purpose as it was in this operation."

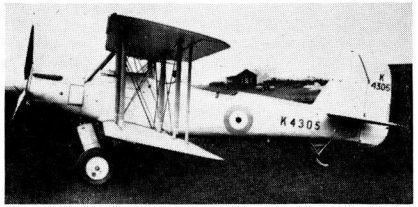
All Swordfish floatplanes were Mk. Is, no conversions of later variants being undertaken. Early production aircraft were powered by the Pegasus IIIM.3, but later aircraft had the Pegasus 30 rated at 820 h.p. for take-off and 870 h.p. at 4,500 ft.

Type: *Two/three-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 870 *h.p. Bristol Pegasus* 30 *nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 0.303-*in. Vickers machine gun and one* 0.303-*in. Lewis gun on flexible mount, plus one torpedo, sea mine or bombs up to a maximum of* 1,500 *lb.* **Performance:** *Maximum speed (torpedo-bomber),* 128 *m.p.h. at* 5,000 *ft., (reconnaissance),* 134 *m.p.h. at* 5,000 *ft.; maximum cruising speed,* 118 *m.p.h.; economical cruising speed,* 101 *m.p.h.; range (with maximum offensive load),* 486 *mls.; initial climb rate,* 985 *ft./min.; time to* 10,000 *ft.,* 14.2 *min.; service ceiling,* 16,950 *ft.* **Weights:** *Empty,* 5,300 *lb.; loaded (torpedo-bomber),* 8,110 *lb., (reconnaissance),* 7,360 *lb.* **Dimensions:** *Span,* 45 *ft.* 6 *in.; length,* 40 *ft.* 6 *in.; height,* 14 *ft.* 7 *in.; wing area,* 607 *sq. ft.*

FAIREY SEAFOX

GREAT BRITAIN

The last British aeroplane specifically designed as a float seaplane, the Seafox was built to specification 11/32 which called for a light reconnaissance floatplane for catapult operation from Trade Route cruisers of the Royal Navy. An all-metal two-bay equal-span biplane with a monocoque fuselage and two-spar wings with fabric covering, the Seafox was unusual in having an open cockpit for the pilot and an enclosed cockpit for the observer, the result of a belief that a canopy would impede the pilot's view for catapult operations.

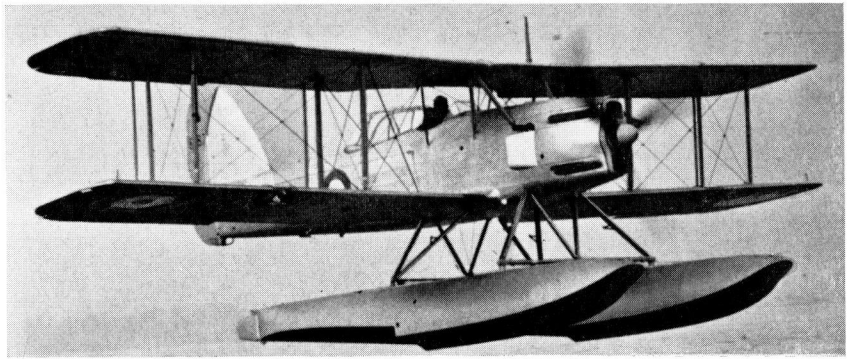


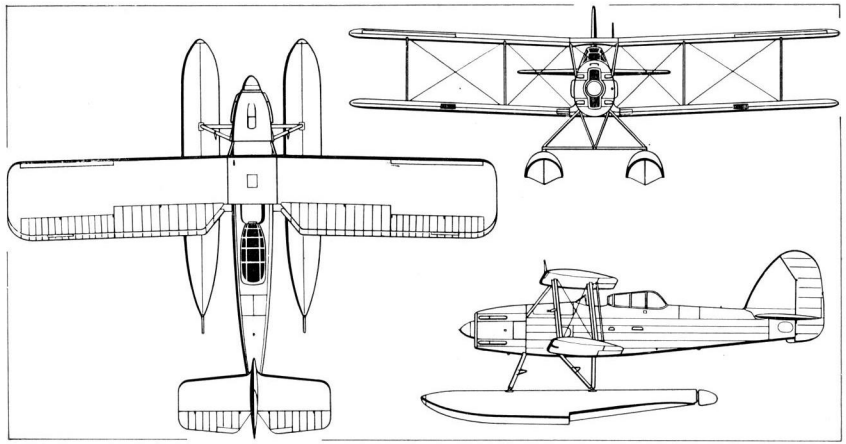
The first prototype (K4304) was flown for the first time on May 27, 1936, four months after the receipt of the first production contract calling for forty-nine Seafoxes (K8569-8617). A second order placed in September 1936 called for a further fifteen machines (L4519-4533), and the second prototype (K4305) was flown on November 5, 1936, with a temporary wheel undercarriage. With one exception (L4523), all production Seafoxes were delivered as floatplanes, the first of these reaching the Navy on April 23, 1937. The Seafox subsequently equipped Nos. 702, 713, 714, 716 and 718 Catapult Flights, and Nos. 753 and 754 training squadrons.

The Seafoxes served aboard various cruisers, and the type will always be associated with the Battle of the River Plate in December 1939, when three British cruisers defeated the *Admiral Graf Spee*. Two Seafoxes were aboard one of the cruisers, H.M.S. *Ajax*, and one of these spotted for the guns during the battle and subsequently reconnoitred the harbour of Montevideo into which the damaged German vessel had put until the battleship was scuttled. This was the first occasion during the Second World War in which a catapult floatplane had served to spot for the guns of a British force during a sea battle.

In January 1940, the aircraft of catapult flights were pooled to form No. 700 Squadron which included eleven Seafoxes on strength, and in December of that year, No. 702 was reformed to operate Seafoxes from armed merchant cruisers. Two Seafoxes were lost when H.M.S. *Orion* went down off Crete in 1941, and the floatplane remained operational until early in 1943.

(*Above*) *The second prototype Seafox with wheel undercarriage, and* (*below*) *an early Seafox* (*K*8587)



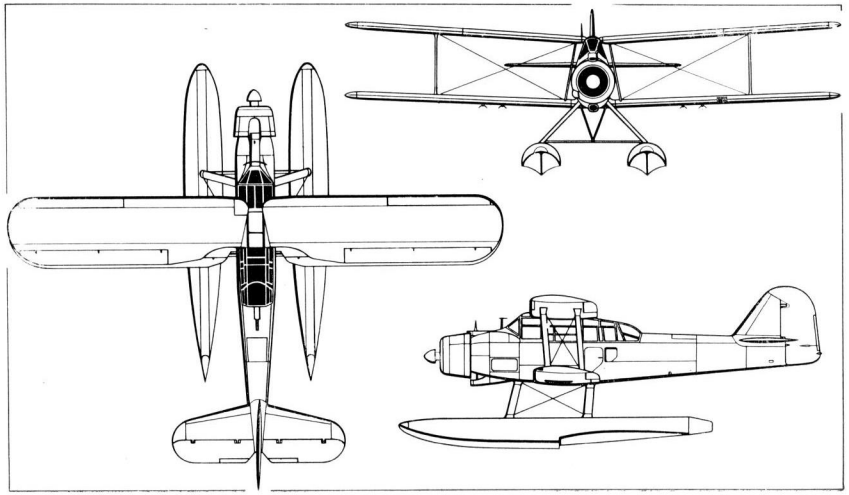


Type: *Two-seat Light Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 395 *h.p. Napier Rapier VI sixteen-cylinder H-type air coooled engine.* **Armament:** *One* 0.303 *in. Lewis machine gun on flexible mount.* **Performance:** *Maximum speed,* 120 *m.p.h. at sea level,* 124 *m.p.h. at* 5,860 *ft.; cruising speed* (*two-thirds power*), 106 *m.p.h. at* 5,860 *ft.; initial climb rate,* 420 *ft./min.; time to* 5,000 *ft.,* 10.4 *min.; service ceiling,* 11,000 *ft.; range,* 440 *mls. at* 106 *m.p.h.; endurance,* 4.15 *hr.* **Weights:** *Empty,* 3,805 *lb.; loaded,* 5,420 *lb.* **Dimensions:** *Span,* 40 *ft.* 0 *in.; length,* 35 *ft.* 5½ *in.; height,* 12 *ft.* 1 *in.; wing area,* 434 *sq. ft.*

FAIREY ALBACORE — GREAT BRITAIN

The Albacore was designed to specification S.41/36 which, intended to provide a replacement for the Swordfish, called for a carrier-borne or shore-based torpedo-spotter-reconnaissance aircraft with three crew members and suitable for operation from either wheels or floats. It was decided to complete the first Albacore prototype (L7074) as a landplane, and the second (L7076) as a floatplane, and, accordingly, a set of single-step, all-metal floats with hydraulically-operated water rudders was designed and built for the aircraft. The first prototype Albacore was flown as a landplane on December 12, 1938, but late in 1939, before the second prototype had flown, the decision was taken to dispense with the float-equipped version, and when this aircraft flew for the first time on February 22, 1940, it was fitted with a wheel undercarriage.

Despite the decision to abandon the float-equipped Albacore, the Navy was still interested in such an aircraft, and the second prototype was delivered to H.M.S. *Ark Royal*, together with its floats, and immediately converted as a floatplane for trials at Gosport and at Fairey's Hamble works where M.A.E.E.



trials were conducted. The floats were braced to the fuselage by two pairs of parallel sloping struts and to each other by spreader bars. Underwing carriers were provided for eight 100-lb. anti-submarine bombs, and minimum and maximum weights for catapult operation were estimated at 8,110 lb. and 10,672 lb.

Trials were conducted at Hamble in March 1940, the tests consisting of water and air handling, take-off and alighting at all-up weights of 10,817 lb. and 11,317 lb. It was soon discovered that the floats were extremely "dirty" through water building up against the noses of the floats, and during taxying at 15 knots the water washed over the forward portions of the floats. There was a tendency to swing and porpoise during take-off, and the water, which built up on the float noses, was thrown up into the airscrew, causing considerable buffeting of the airscrew in only slightly choppy water. In the air it was found that the controls were not evenly harmonised, and the rudder was extremely heavy. The aircraft tended to hunt directionally and a change of air speed necessitated a substantial change in rudder trim. There was a tendency to alight with the heels of the floats down, but the hydraulic water rudders were found to be extremely effective, and the mechanical system available in the event of an hydraulic failure was also satisfactory.

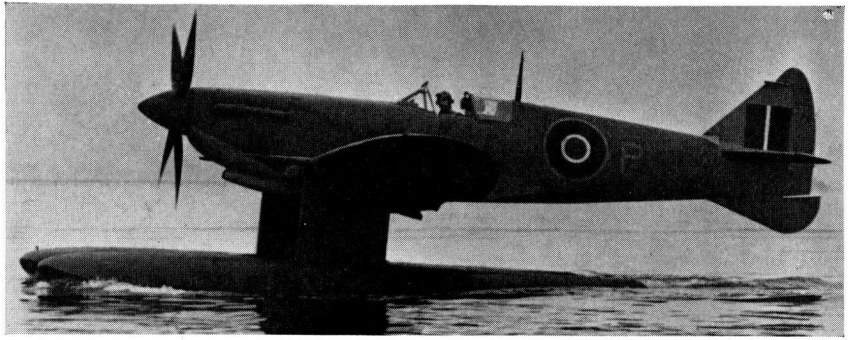
The extreme dirtiness of the floats, however, placed a serious handicap on the use of the Albacore floatplane, and its further development was abandoned.

Type: *Three-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 1,065 *h.p. Bristol Taurus I.M(a) fourteen-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 0.303-*in. Vickers machine gun and twin* 0.303-*in. Vickers "K" guns on flexible mount, plus eight* 100-*lb. anti-submarine bombs.* **Performance:** *Maximum speed,* 150 *m.p.h. at* 4,000 *ft.; maximum cruising speed,* 126 *m.p.h. at* 6,000 *ft.; economical cruising speed,* 112 *m.p.h.; range (with* 800-*lb. warload),* 820 *mls.; service ceiling,* 17,800 *ft.* **Weights:** *Normal loaded,* 11,317 *lb.; maximum loaded for catapult operation,* 10,672 *lb.* **Dimensions:** *Span,* 50 *ft.* 0 *in.; length,* 42 *ft.* 5½ *in.; height,* 16 *ft.* 8⅛ *in.; wing area,* 623 *sq. ft.*

SUPERMARINE SPITFIRE — GREAT BRITAIN

The invasion of Norway by German forces on April 9, 1940, brought to the fore Britain's urgent need for a floatplane fighter capable of operating from Norwegian fjords or other sheltered strips of water, and as a panic measure, both Vickers-Armstrongs and Hawkers were asked to produce float-equipped versions of their respective fighters, the Spitfire and the Hurricane. In the event, the Norwegian campaign terminated before either float fighter was flown, but while further work on the Hurricane floatplane was abandoned, development of the Spitfire floatplane continued, resulting in the fastest float seaplanes of the Second World War.

The original Spitfire floatplane project, the Type 342, known less officially as the "Narvik Nightmare", was begun in April 1940, and owing to the exigencies of the time was an adaptation of a standard Spitfire II to take a pair of single-step Alclad Blackburn Shark floats similar to those employed by the Roc floatplane. These floats were obviously too large and too heavy for the Spitfire, and there



The Type 355 prototype conversion Spitfire VB floatplane (W3760) produced by Folland.

were some doubts that the bracing structure between floats and wings would possess sufficient strength. It was perhaps fortunate, therefore, that the conversion was never completed, the onset of the "Battle of Britain" necessitating the reconversion of the aircraft as a standard Spitfire II.

In May 1940, a conversion of the Spitfire with floats of Supermarine design, the Type 344, was already proposed, but it was not until September 1941 that the scheme was revived with the Type 355, a conversion of a Spitfire VB (W3760) to take Supermarine-designed floats. The actual conversion was undertaken by Folland Aircraft, and apart from the attachments of the floats by cantilever pylons to the inboard wing sections, the aircraft had the carburettor air intake extended forward to avoid the entry of water spray, and the vertical tail surfaces were increased in area by the forward extension of the fin and the provision of an additional ventral fin.

Initial trials revealed that the water handling of the Spitfire floatplane and its behaviour during taking-off and alighting were very good, and at normal taxying speeds in winds up to 20 m.p.h. only a fine spray was thrown into the airscrew arc. In the air the fighter handled well, except for an appreciable change in elevator trim during diving and a substantial yaw which developed when the pilot throttled back, and the addition of the floats had very little effect on manoeuvrability which was of an extremely high order.

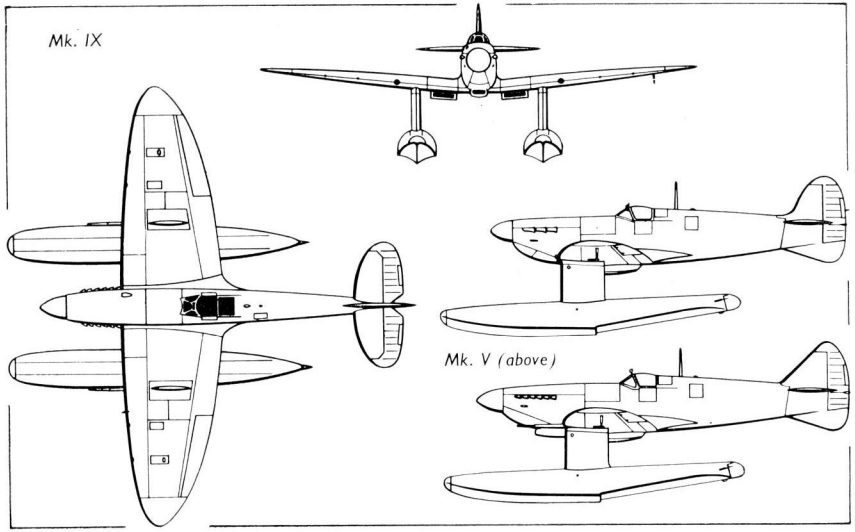
As a result of the success of initial trials. Folland Aircraft were instructed to manufacture twelve sets of floats and conversion kits, and two further Spitfire VBs were converted (EP751 and EP754). However, a change in policy after the completion of the first two "production" conversions resulted in the discontinuation of further work on the Spitfire VB floatplane in favour of a conversion of the more powerful Spitfire IX. Eight sets of floats

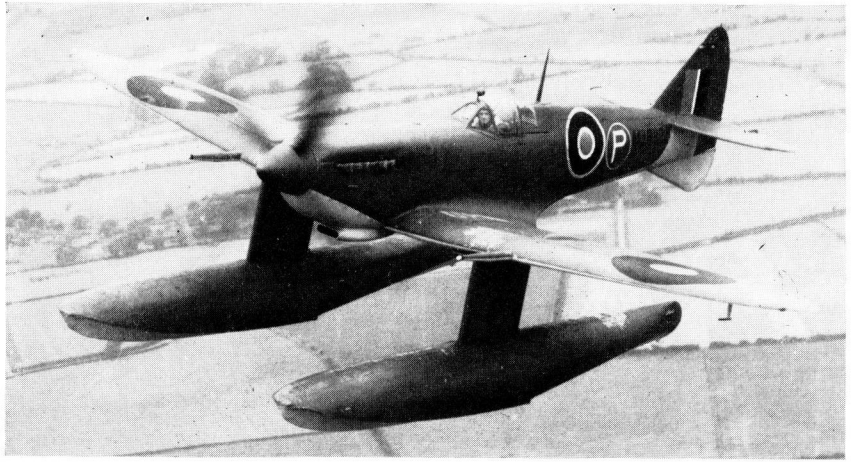
already manufactured were modified for installation on the later Spitfire variant, and a Spitfire IX (MJ892) was converted as a prototype, the modifications being substantially the same as those made to the earlier conversions.

The Spitfire IX floatplane displayed an outstanding performance and would undoubtedly have proved its worth in the Pacific, but official policy dictated concentration on carrier-borne rather than float-equipped fighters, and the whole scheme was abandoned early in 1944.

The first of the following specifications relates to the Spitfire VB floatplane conversion, and the second covers the Spitfire IX conversion.

Type: *Single-seat Twin-float Fighter Seaplane.* **Power Plant:** *One* 1,470 *h.p. Rolls-Royce Merlin* 45 *twelve-cylinder Vee liquid-cooled engine.* **Armament:** *Two* 20-*mm. Hispano cannon with* 120 *r.p.g. and four* 0.303-*in. Browning machine guns with* 350 *r.p.g.* **Performance:** *Maximum speed,* 251 *m.p.h. at sea level,* 267 *m.p.h. at* 5,000 *ft.,* 306 *m.p.h. at* 15,500 *ft.,* 324 *m.p.h. at* 19,500 *ft.; economical cruising speed,* 180 *m.p.h. at* 6,000 *ft.,* 200





The fastest wartime float seaplane, a conversion of a Spitfire IX (MJ892).

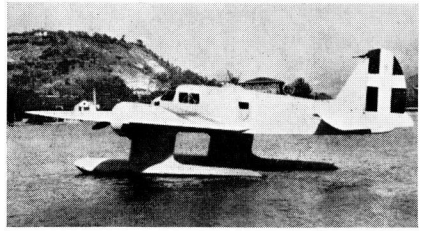
m.p.h. at 20,000 *ft.; initial climb rate,* 2,240 *ft./min.; maximum climb rate,* 2,450 *ft./min. at* 15,500 *ft.; time to* 5,000 *ft.,* 2.2 *min., to* 10,000 *ft.,* 4.4 *min., to* 25,000 *ft.,* 12.3 *min.; service ceiling,* 33,400 *ft.; range,* 336 *mls. at* 200 *m.p.h. at* 20,000 *ft.* **Weights:** *Empty,* 6,014 *lb.; normal loaded,* 7,580 *lb.* **Dimensions:** *Span,* 36 *ft.* 10 *in.; length,* 35 *ft.* 4 *in.; height,* 13 *ft.* 10 *in.; wing area,* 242 *sq. ft.*

Type: *Single-seat Twin-float Fighter Seaplane.* **Power Plant:** *One* 1,720 *h.p. Rolls-Royce Merlin* 66 *twelve-cylinder Vee liquid-cooled engine.* **Armament:** *Two* 20-*mm. Hispano cannon with* 120 *r.p.g. and four* 0.303-*in. Browning machine guns with* 350 *r.p.g.* **Performance:** *Maximum speed,* 316 *m.p.h. at sea level,* 353 *m.p.h. at* 9,000 *ft.,* 377 *m.p.h. at* 19,700 *ft.; economical cruising speed,* 225 *m.p.h. at* 10,000 *ft.; initial climb rate,* 3,700 *ft./min.; maximum climb rate,* 3,800 *ft./min. at* 6,500 *ft.; service ceiling,* 36,000 *ft.; range,* 460 *mls. at* 225 *m.p.h. at* 10,000 *ft.* (*with* 50 *Imp. gal. drop tank*), 770 *mls.* **Weights:** *Empty,* 6,500 *lb.; normal loaded,* 8,200 *lb.; maximum,* 8,610 *lb.* **Dimensions:** *Span,* 36 *ft.* 10 *in.; length,* 35 *ft.* 6 *in.; height* (*tail down on land*), 10 *ft.* 0 *in.; wing area,* 242 *sq. ft.*

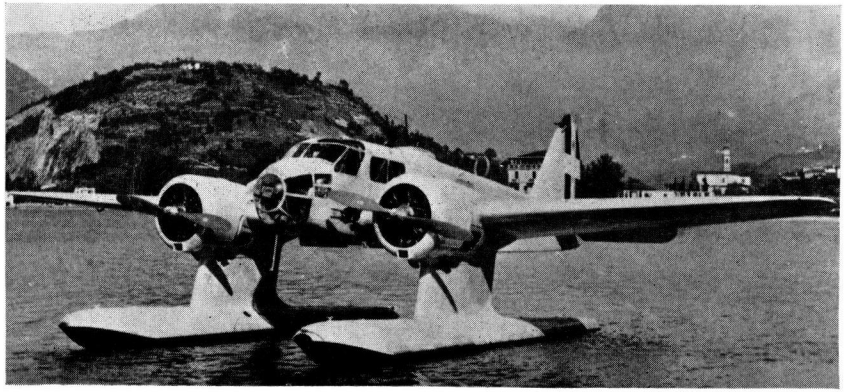
CAPRONI CA.316 ITALY

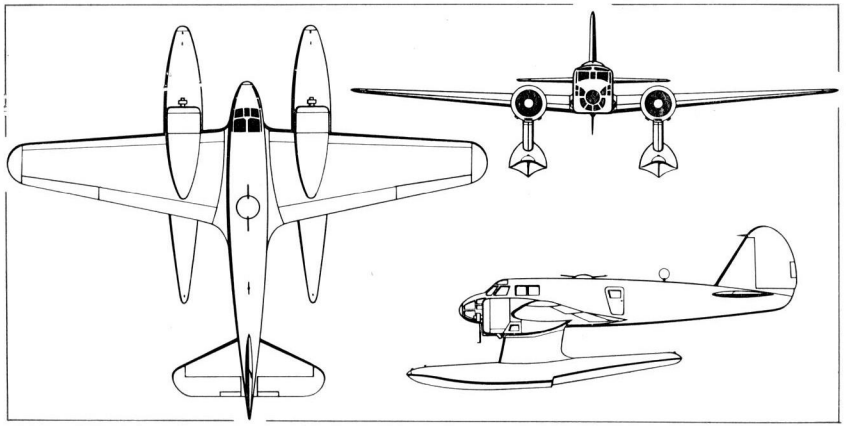
Designed to succeed the I.M.A.M. Ro.43 as a catapult floatplane aboard *Littorio* class battleships of the Italian Navy, the Ca.316 was designed by Cesare Pallavicino of the Cantieri Aeronautici Bergamaschi, one of the Caproni group of companies. The Ca.316 was a progressive development of a series of light, twin-engined multi-purpose aircraft stemming from the Ca.309 Ghibli and Ca.310 Libeccio of 1936, and was evolved in parallel with the land-based Ca.313 and Ca.314 light reconnaissance bombers.

The prototype Ca.316 was flown for the first time late on August 14, 1940 at Montecollino on Lake Iseo with moderately supercharged Piaggio P.VII C.16 seven-cylinder radial engines rated at 430 h.p. for take-off and 460 h.p. at 5,350 ft., although it was proposed that the production model would receive



The Ca.316 was designed to replace the Ro.43 aboard Littorio class battleships of the Italian Navy.





P.VII C.35 engines offering 500 h.p. for take-off and 460 h.p. at 11,480 ft. The Ca.316 was of mixed construction, the wing being of wood with two box spars, former ribs and plywood covering, and the fuselage was a welded steel-tube structure covered by light alloy panels forward and fabric aft. The floats were of all-metal construction, and accommodation was provided for three crew members. Provision was made for an 880-lb. bomb load or a single torpedo, and defensive armament comprised a single 12.7-mm. Breda-SAFAT machine gun in the port wing root and one 7.9-mm. machine gun in a Lanciani dorsal turret.

The Ca.316 was extensively tested at the Vigna di Valle base by Comandante De Bernardi, but production priority was allocated to the Ca.313 and Ca.314, production plans for the floatplane being progressively postponed until they were finally abandoned in 1942. Several float seaplane variants of the land-based Ca.312 were projected during 1939-40, but these were not proceeded with.

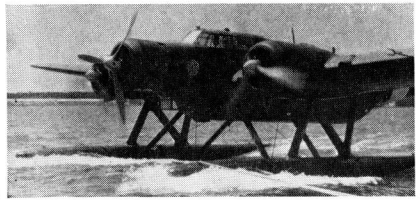
Type: *Three-seat Catapult Reconnaissance-bomber Float Seaplane.* **Power Plants:** *Two* 460 *h.p. Piaggio P.VII C.*16 *seven-cylinder radial air-cooled engines.* **Armament:** *One* 7.9-*mm. and one* 12.7-*mm. machine guns plus an* 880-*lb. bomb load or torpedo.* **Performance:** *Maximum speed,* 204 *m.p.h. at* 4,920 *ft.; maximum cruising speed,* 186 *m.p.h.; economical cruising speed,* 152 *m.p.h.; service ceiling,* 19,685 *ft.; range (at economical cruising speed),* 995 *mls.* **Weights:** *Loaded,* 10,590 *lb.* **Dimensions:** *Span,* 52 *ft.* 2 *in.; length,* 42 *ft.* 3½ *in.; height,* 16 *ft.* 9 *in.; wing area,* 409.029 *sq. ft.*

C.R.D.A.CANT Z.506B AIRONE

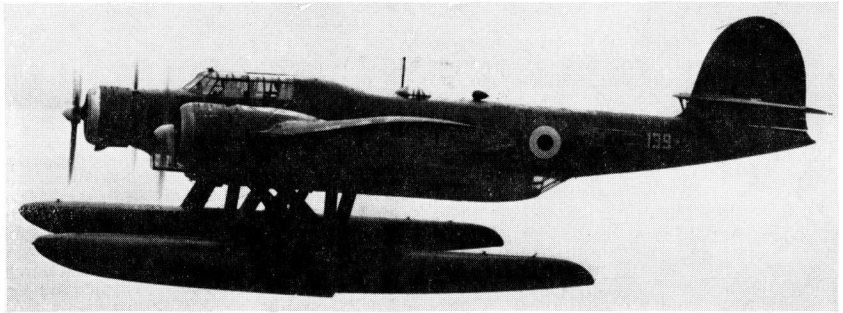
ITALY

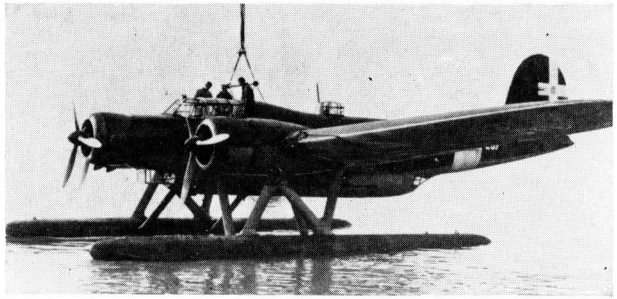
The Cantieri Riuniti Dell'Adriatico, or C.R.D.A., which stemmed from the famous naval construction company of Cantiere Monfalcone, concentrated largely on the construction of sea-going aircraft, and undoubtedly the most important of these was the Z.506B Airone (Heron) tri-motor twin-float reconnaissance-bomber designed by Filippo Zappata. The Airone was evolved in 1936 from the commercial Z.506A which, in the following year, established sixteen world records in its class, comprising eleven speed records with load, three closed-circuit distance records and two load-to-altitude records. The principal external differences between the Z.506A and the Z.506B were the introduction of a long ventral gondola and a dorsal turret with stepped upper fuselage contours in the military model.

Production of the Z.506B Airone began in 1937, the initial batch (Serie I—MM 45192-223) comprising thirty-two machines and entering service in 1938. Of wooden construction, the Airone was powered by three Alfa Romeo 126 R.C. 34 nine-cylinder air-cooled radials each rated at 750 h.p. for take-off and having a normal output of 680 h.p. at 2,300 r.p.m. at sea level. The forward portion of the ventral gondola provided accommodation for the bombardier and the rear portion housed a 7.7-mm. Breda-SAFAT machine gun on a flexible mount with 500 rounds. The bomb-bay between the bombardier's and ventral



(Below and above, right) The Cant Z.506B, the most important Italian wartime water-borne aircraft.





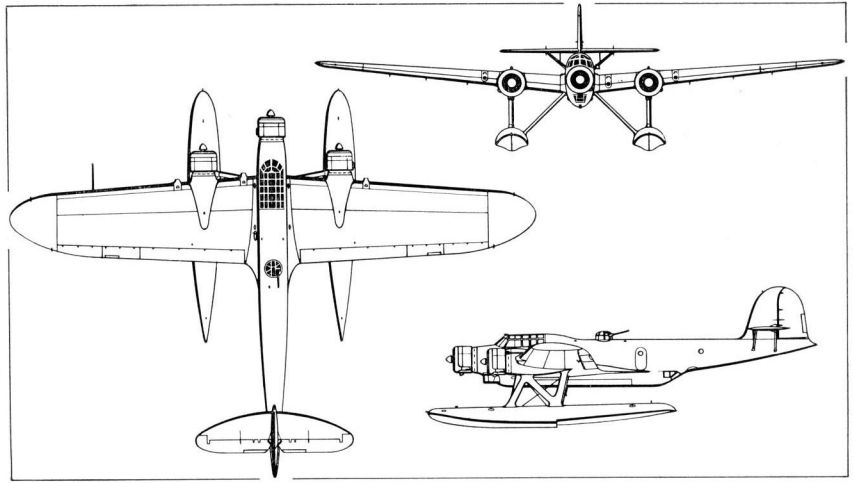
The Z.506B possessed particularly pleasant handling characteristics.

gunner's positions could house a single 1,764-lb. torpedo, or sixteen 33-lb. or 44-lb. bombs, nine 110-lb. or 220-lb. bombs, four 353-lb. and three 110-lb. bombs, two 551-lb. and three 110-lb. bombs, two 1,100-lb. bombs or one 1,764-lb. bomb.

The Z.506B Serie I was evaluated under operational conditions with the *Aviacion Legionaria* during the final stages of the Spanish Civil War, and in 1938, thirty Airone floatplanes were ordered for the Polish Naval Wing. In the event, the first machine of this order was collected by a Polish crew and reached Poland on August 27, 1939, a few days before the German invasion of that country, but ammunition for the Breda-SAFAT machine guns had not accompanied the machine which was eventually destroyed on the water by the Luftwaffe, the remaining aircraft on the Polish order being taken over by the Regia Marina.

By the time Italy entered the Second World War, the Monfalcone plant of the C.R.D.A. had produced ninety-five Airone floatplanes, and the Piaggio company had joined the production programme. In June 1940, the Airone equipped the 31° Stormo Autonomo Bombardamento Marittimo based at Elmas (Cagliari) and the 35° Stormo Bombardamento Marittimo at Brindisi. The Airone floatplanes were initially used primarily in the bomber role, attacking French and Greek targets, and participating in operations against the British Fleet in the Mediterranean, notably during the Battle of Punta Stilo. Airone floatplanes of the 35° Stormo also participated in the occupation of the Greek islands of Corfu, Cefalonia and Zante in April-May 1941, but subsequently the Regia Marina requested that all aircraft of this type be assigned to the Ricognizione Marittima units, and thenceforth the Airone was used primarily for coastal reconnaissance, convoy escort and anti-submarine operations.

Several series of the Airone were produced, the most important of these being the Serie XII in which the maximum bomb load was raised from 2,200 lb. to 2,645 lb., the Breda M.1 dorsal turret was supplanted by a Caproni-Lanciani Delta E turret housing a 12.7-mm. Scotti machine gun with 350 rounds, two lateral 7.7-mm. Breda-SAFAT machine guns with 500 r.p.g. were added to the defensive armament, and empty and loaded weights were increased from 18,298 lb. and 27,116 lb. to 19,290 lb. and 28,008 lb. respectively. A number of Airone floatplanes were converted for air-sea rescue duties under the designation Z.506S (Soccorso), and aircraft of this type



were also used by the Luftwaffe operating in the Mediterranean.

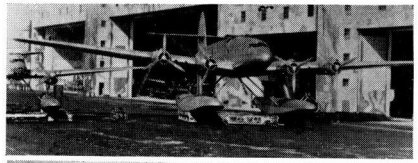
After the Armistice, twenty-eight Airone floatplanes were flown to the Allied lines (twenty-three Z.506Bs and five Z.506Ss) and incorporated in the Italian Co-Belligerent Air Force's *Raggruppamento Idro* in Southern Italy, operating until the end of the war in the transport and rescue roles. The Airone possessed extremely pleasant handling characteristics. The design of the floats was particularly successful, permitting take-offs in conditions up to and including Force 4 and landings in conditions as rough as Force 5.

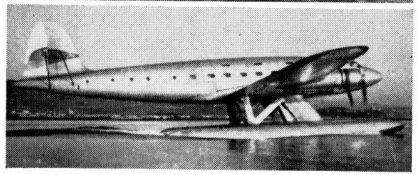
The following specification relates to the Z.506B Serie XII.

Type: *Five-seat Bomber-reconnaissance and Torpedo Float Seaplane.* **Power Plants:** *Three* 750 *h.p. Alfa Romeo* 126 *R.C.* 34 *nine-cylinder radial air-cooled engines.* **Armament:** *One* 12.7-*mm. Scotti machine gun with* 350 *rounds and three* 7.7-*mm. Breda-SAFAT machine guns with* 500 *r.p.g., plus a* 2,645-*lb. bomb load or a* 1,764-*lb. torpedo.* **Performance:** *Maximum speed,* 217 *m.p.h. at* 13,120 *ft.; cruising speed,* 186 *m.p.h. at* 13,120 *ft.; time to* 13,120 *ft.,* 20 *min., to* 19,685 *ft.,* 24 *min.; range (with* 2,095-*lb. bomb load),* 1,243 *mls.; endurance,* 6 *hr.* 26 *min.* **Weights:** *Empty,* 19,290 *lb.; loaded,* 28,008 *lb.* **Dimensions:** *Span,* 86 *ft.* 11½ *in.; length,* 63 *ft.* 1¾ *in.; height,* 24 *ft.* 5½ *in.; wing area,* 928.493 *sq. ft.*

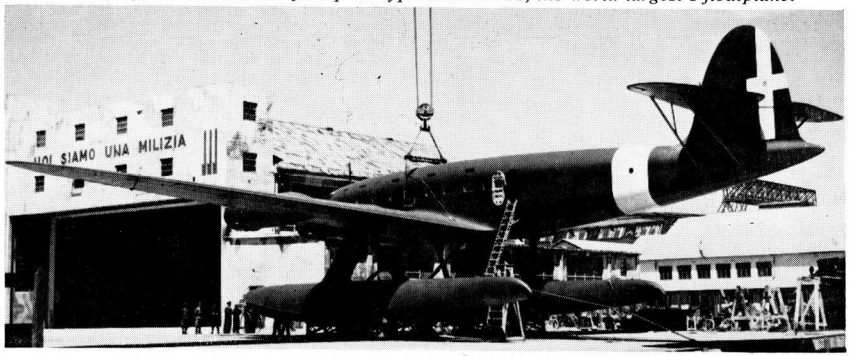
Designed by Filippo Zappata for use on the South Atlantic route of L.A.T.I., the Z.511 was the world's largest float seaplane. Construction of two prototypes of the Z.511 began at Monfalcone in 1941, and in its commercial form the floatplane was intended to provide de luxe accommodation for sixteen passengers in four cabins. All-metal construction was employed, and power was provided by four Piaggio P.XII R.C. 35 eighteen-cylinder double-row air-cooled radials each rated at 1,500 h.p. for take-off and 1,350 h.p. at 11,480 feet. The fuselage featured two decks, and catwalks in the wing leading edges permitted mechanics to reach the engines while the aircraft was in flight. The floats provided storage space for engine spares and other stores, and could be reached in flight via ladders in the main struts from the wing catwalks.

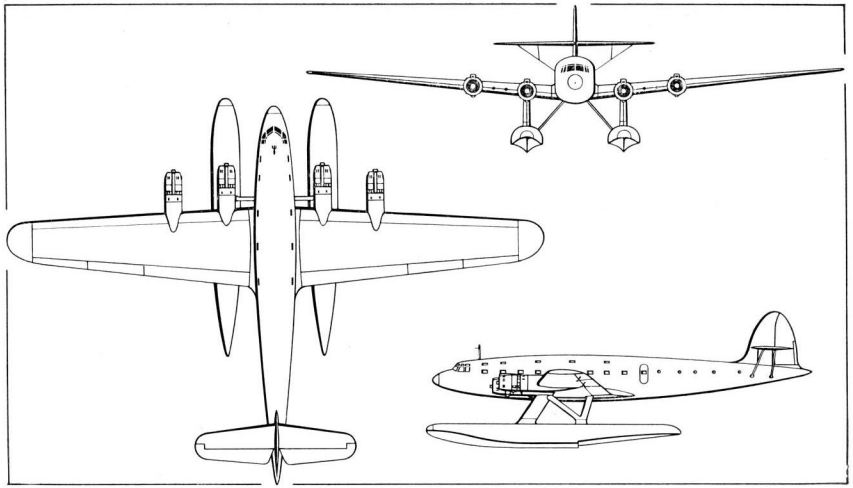
Early in 1942 it was decided to complete the prototypes of the Z.511 as military transports, and the first of these flew on September 8, 1943, but was destroyed shortly afterwards at Vigna di Valle in a strafing attack by Allied aircraft. The second prototype was commandeered by the Luftwaffe at Monfalcone and after dismantling was transported to Germany as scrap.





(*Above, left and below*) *The first prototype Cant Z.511, the world largest's floatplane.*





Although only limited trials were undertaken with the first Z.511 prototype, it proved to be extremely manoeuvrable for its size, and its characteristics, both in the air and on the water, were excellent. The second prototype had provision for the installation of a defensive armament comprising five 7.7-mm machine guns which were to have been fired through windows in the fuselage sides, and consideration was given to the production of a military transport version with turreted armament, although this never progressed further than the drawing board.

Type: *Long-range Transport Float Seaplane.* **Power Plants:** *Four* 1,500 *h.p. Piaggio P.XII R.C.*35 *eighteen-cylinder radial air-cooled engines.* **Armament** (*Proposed for the second prototype*): *Five* 7.7-*mm. SAFAT machine guns.* **Performance:** *Maximum speed,* 261 *m.p.h. at* 13,125 *ft.; economical cruising speed,* 205 *m.p.h. at* 13,125 *ft.; normal endurance,* 12 *hr.; time to* 13,125 *ft.,* 16 *min.; service ceiling,* 22,965 *ft.; range,* 2,485 *mls. at* 205 *m.p.h.* **Weights:** *Empty,* 45,106 *lb.; loaded,* 73,987 *lb.* **Dimensions:** *Span,* 131 *ft.* 2¾ *in.; length,* 93 *ft.* 6 *in.; height,* 36 *ft.* 1 *in.; wing area,* 2,098.96 *sq. ft.*

C.R.D.A.CANT Z.515

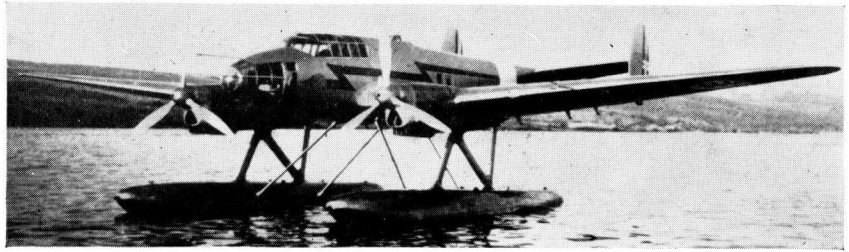
ITALY

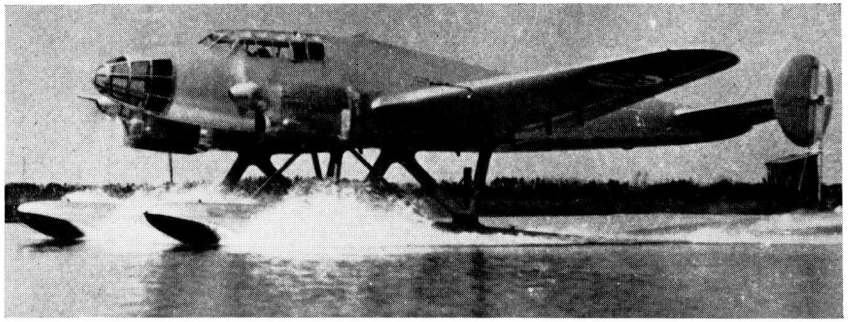
The Z.515 was designed by Filippo Zappata to compete with the Fiat R.S.14 as a replacement for the Z.501 Gabbiano flying boat (see page 120, Volume V) in the coastal reconnaissance role, and its conception owed much to that of the Z.1018 Leone land-based bomber. The design of the Z.515 was initiated in 1938, although the prototype did not, in fact, fly until 1942, by which time the R.S.14 was firmly established in service.

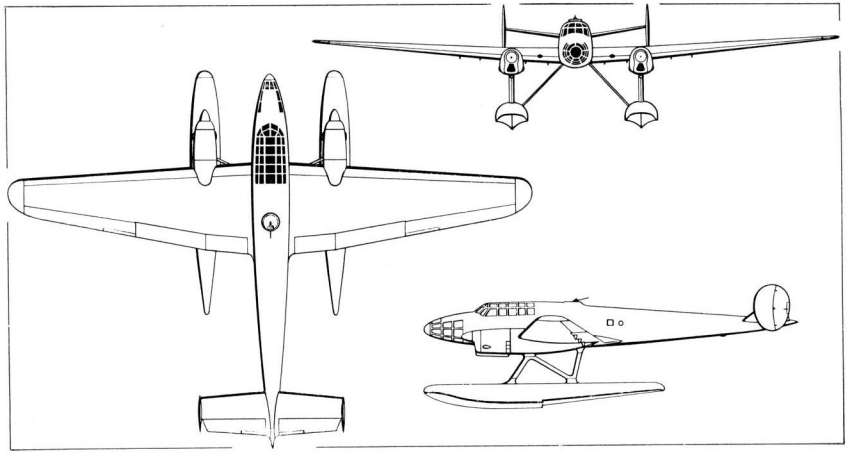
Initially, wooden construction was proposed for the Z.515 floatplane and, in fact, the prototype was built of wood as was that of the Z.1018 Leone, but the Cantieri Riunity Dell' Adriatico proposed that the production model should be of all-metal construction. Possessing exceptionally clean lines, the Z.515 prototype was powered by two Delta R.C.35-I twelve-cylinder inverted-Vee air-cooled engines, and in view of the fact that the two engines provided a total power of only 1,400 h.p. its performance was good. Proposed armament comprised one 12.7-mm. Scotti machine gun in a Caproni-Lanciani dorsal turret and two 7.7-mm. SAFAT machine guns firing from beam positions, and proposed offensive armament consisted of six anti-submarine bombs of up to 353 lb. each. AGR 90 and APR reconnaissance cameras were to have been installed.

Trials with the Z.515 indicated that the floatplane possessed good characteristics, but the C.R.D.A. was fully occupied in producing the Z.1018 Leone bomber, and no capacity was available for the production of the Z.515 which progressed no further than the prototype stage.

Type: *Three-four-seat Coastal Reconnaissance-bomber Float Seaplane.* **Power Plants:** *Two* 700 *h.p. Isotta-Fraschini Delta R.C.35-I twelve-cylinder inverted-Vee air-cooled engines.* **Armament:** *One* 12.7-*mm. Scotti machine gun with* 350 *rounds and two* 7.7-*mm. SAFAT machine guns with* 500 *r.p.g., plus a* 2,118-*lb. bomb load.* **Performance:** *Maximum speed,* 238 *m.p.h. at* 14,435 *ft.; economical cruising speed,* 188 *m.p.h. at* 7,545 *ft.; time to* 6,560 *ft.,* 6 *min.* 4 *sec., to* 16,400 *ft.,* 17 *min.* 48 *sec.; range,* 1,180 *mls. at* 188 *m.p.h. at* 7,545 *ft.* **Weights:** *Empty,* 14,109 *lb.; loaded,* 19,070 *lb.* **Dimensions:** *Span,* 73 *ft.* 9¾ *in.; length,* 52 *ft.* 7½ *in.; height,* 19 *ft.* 2¾ *ins.; wing area,* 678.126 *sq. ft.*







FIAT R.S.14

ITALY

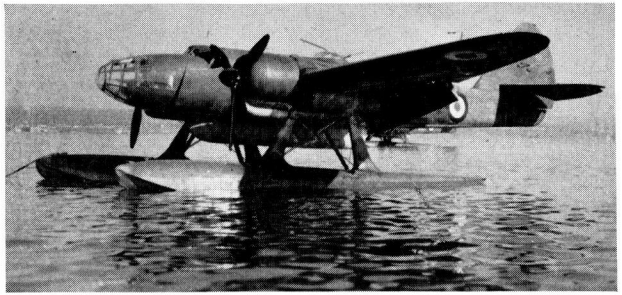
Designed by Ing. Stiavelli under the supervision of Celestino Rosatelli and manufactured by the Costruzioni Meccaniche Aeronautiche S.A. (C.M.A.S.A.) at Marina di Pisa, the R.S.14 was one of the outstanding float seaplanes of the Second World War. Of exceptionally clean design, the R.S.14 was an all-metal stressed-skin monoplane with twin single-step floats attached to the engine nacelles by pairs of vertical struts and braced to the fuselage by parallel sloping struts, and the first of two prototypes was flown in 1938 as the R.S.14A. Trials with the prototypes were extremely successful, the floatplane proving to have exceptional performance and manoeuvrability and the type was immediately ordered into production for the *Ricognizione Marittima*.

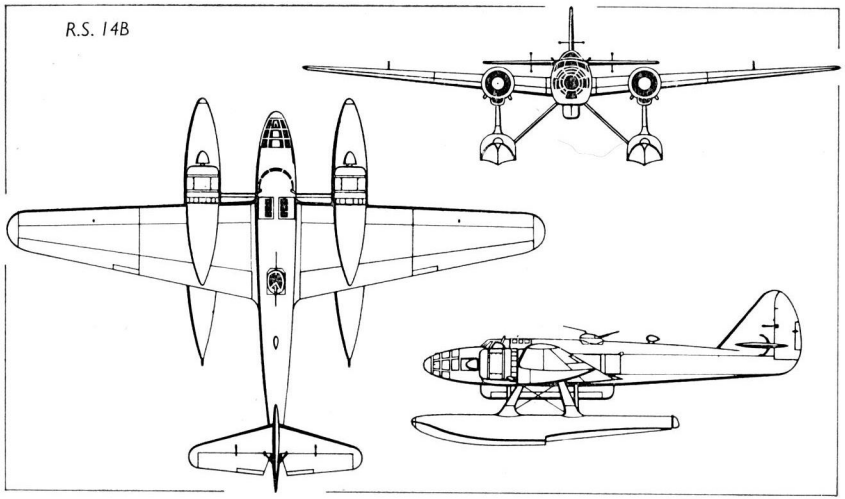
The initial production model, the R.S.14B differed from the prototypes in minor respects only, the nose glazing being modified and gun hatches being added in the fuselage sides, just aft of the wing trailing edges, these each mounting a single 7.7-mm. machine gun with 500 rounds. The remaining defensive armament consisted of a Lanciani Type E dorsal turret with a single 12.7-mm. gun and 350 rounds plus a further 300 rounds in reserve. All offensive armament was accommodated in a detachable ventral tray which could house two 353-lb depth charges, four 220-lb. bombs of various types, or six 88-lb. or 110-lb. bombs. Six fuel tanks were installed in the wings, fuselage and floats, total capacity being 594 Imp. gal., and a crew of four or five was carried.

Deliveries of the R.S.14B were made to several strategic reconnaissance squadrons in 1941, and operating from bases on Sardinia and in the Aegean Islands, the aircraft was soon active in the reconnaissance role, in escorting convoys and supporting naval operations, and even as a defensive fighter. The R.S.14C was identical to the R.S.14B apart from the removal of the ventral weapons tray, being used in this form primarily in the air-sea rescue role.

A total of 150 R.S.14B and C floatplanes was built by C.M.A.S.A., but only twelve in serviceable condition were available to the Regia Aeronautica on October 28, 1943, when the *Aviazione della RSI* was formed to continue fighting alongside the Luftwaffe, twelve having flown South in answer to Marshal Badoglio's call, ten of these reaching the Allied lines to operate from Taranto with the Italian Co-Belligerent Air Force, and continuing to serve with the *Aeronautica Militare* after the cessation of hostilities. An attack version of the R.S.14 with a fully-retractable wheel undercarriage replacing the floats and designated A.S.14 was developed and flown, and this variant is described in the appropriate volume.

One of the Fiat R.S.14B floatplanes which flew south in answer to Marshal Badoglio's call and operated from Taranto with the Co-Belligerent Air Force.



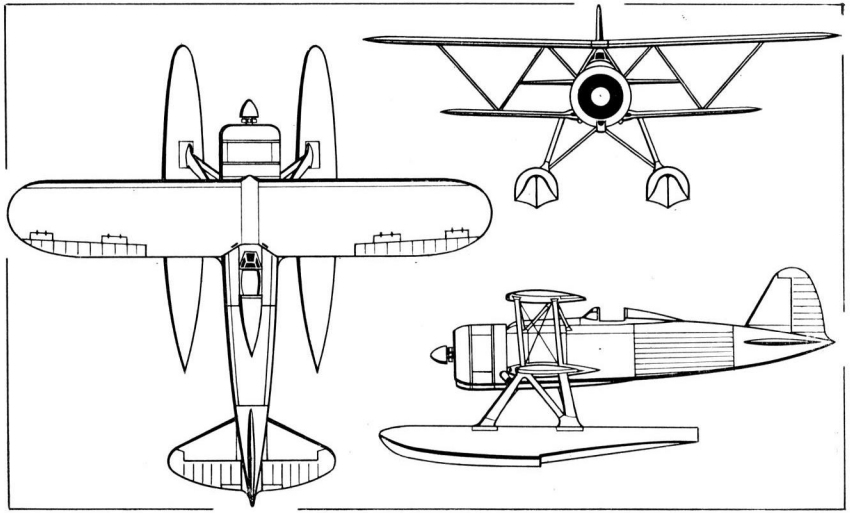


Type: *Four/five-seat Reconnaissance-bomber Twin-float Seaplane.* **Power Plants:** *Two* 870 *h.p. Fiat A* 74 *R.C.*38 *fourteen-cylinder radial air-cooled engines.* **Armament:** *One* 12.7-*mm. Scotti machine gun in Lanciani Type E dorsal turret and two* 7.7-*mm. Breda-SAFAT machine guns on flexible mounts firing from lateral positions, plus two* 353-*lb. depth charges or four* 220-*lb. or six* 88-*lb. or* 110-*lb. bombs.* **Performance:** *Maximum speed,* 242 *m.p.h. at* 13,120 *ft.; cruising speed,* 205 *m.p.h.; time to* 16,400 *ft.,* 15 *min.; service ceiling,* 16,400 *ft.; maximum range (at* 18,739 *lb.),* 1,553 *mls.* **Weights:** *Empty,* 12,125 *lb.; normal loaded,* 17,637 *lb.; maximum.* 18,739 *lb.* **Dimensions:** *Span,* 64 *ft.,* 0⅞ *in.; length,* 44 *ft.* 11 *in.; height,* 17 *ft.* 9 *in.; wing area,* 538.196 *sq. ft.*

FIAT I.C.R.42 ITALY

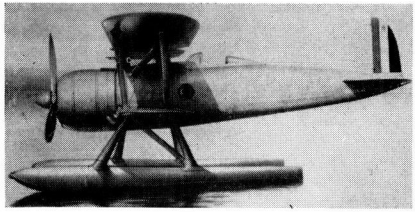
The Regia Aeronautica was for many years a staunch advocate of the single-seat float fighter, but as speeds increased the penalty imposed by the drag of the floats became prohibitive, widening the performance gap between land-based and water-borne fighters to an unacceptable degree, and by the time Italy had been at war for a year her air arm had abandoned its adherence to float-equipped fighters, and most warplanes of this type had been withdrawn from first-line service. However, in 1939, when work on the Fiat I.C.R.42 began, the single-seat float fighter appeared still to have its operational uses.

The I.C.R.42 was a twin-float seaplane derived from the land-based C.R.42 Falco fighter (see Vol. II, page 139), the "I" prefix indicating *Idrovolante*, or seaplane. Intended as a successor to the Ro.44 with the *Squadriglie Forze Navali*, the I.C.R.42 had twin single-step metal floats attached to the fuselage and the lower wing centre section by aerofoil-section metal struts, and the conversion of a standard C.R.42 Falco as the prototype I.C.R.42 was



entrusted to a subsidiary of Fiat, the Costruzioni Meccaniche Aeronautiche S.A. (C.M.A.S.A.) at Marina di Pisa.

The I.C.R.42 was flown for the first time in 1940, at which time the Italian Air Ministry was reportedly contemplating the placing of an initial order for forty machines of this type to operate from sheltered waters around the Italian coastline. In the event, only the prototype was completed as it was generally conceded that the float fighter concept was outdated, such aircraft being too vulnerable for operation in areas where enemy land-based fighters might be encountered.

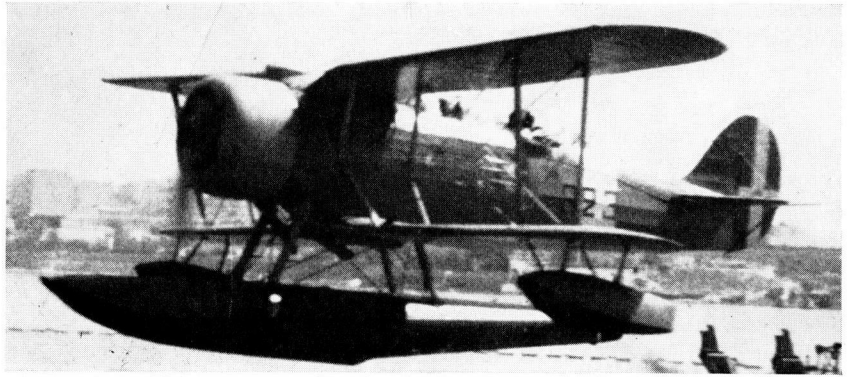


Type: *Single-seat Fighter Twin-float Seaplane.* **Power Plant:** *One* 870 *h.p. Fiat A* 74 *R.C.*38 *fourteen-cylinder radial air-cooled engine.* **Armament:** *One* 7.7-*mm. and one* 12.7-*mm. machine gun.* **Performance:** *Maximum speed,* 262 *m.p.h. at* 13,120 *ft.; service ceiling,* 29,530 *ft.; maximum ceiling,* 31,170 *ft.; range (with* 22 *Imp. gal. auxiliary tank),* 590 *mls.* **Weights:** *Empty,* 4,078 *lb.; loaded,* 5,346 *lb.* **Dimensions:** *Span,* 31 *ft.* 9¾ *in.; length,* 30 *ft.* 2¾ *in.; height,* 10 *ft.* 11⅞ *in.; wing area,* 240.573 *sq. ft.*

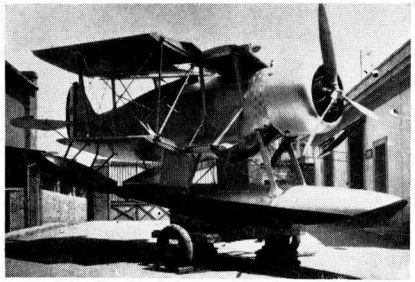
I.M.A.M. RO.43 AND RO.44 ITALY

The two-seat Ro.43 and single-seat Ro.44 were evolved during 1935-36 from the Ro.37bis land-based reconnaissance aircraft by the S.A. Industrie Meccaniche e Aeronautiche Meridionali for use aboard the larger warships of the Italian Navy. The Ro.43 and Ro.44 were essentially similar apart from armament and the number of crew members carried, and both were powered by the Piaggio P.X R nine-cylinder radial air-cooled engine rated at 670 h.p. for take-off and having a maximum output of 700 h.p. at 3,280 ft., although the prototype Ro.43 had a 610 h.p. Piaggio P.IX RC 40. The Ro.43 and 44 were unequal-span, folding-wing biplanes of mixed construction, the fuselages being welded steel-tube structures with light alloy and fabric skinning, and the wings having welded steel-tube spars and wooden ribs with fabric covering. The single-step central floats were of wooden construction and attached to the fuselages by short, wire-braced struts.

On November 1, 1939, the Ro.43 equipped twenty shipboard reconnaissance floatplane elements, 101 machines of this type being in service and a further twenty-nine being under construction. When Italy entered the Second World War, 105 were in service of which sixty-four were attached to *Squadriglie* of the Naval Force, although only forty-two of these were serviceable, eleven were stored at naval depots, and thirty were undergoing overhaul or repair. Many of the serviceable Ro.43s were aboard vessels of the Italian Navy, a *Littorio* class battleship sometimes carrying as many as three machines of this type for gunnery observation and reconnaissance. Despite the fact that the Ro.43 possessed a low performance and poor "rough sea" characteristics, and was inadequately armed, it remained



An Ro.43 reconnaissance floatplane leaving the catapult of an Italian warship.



The Ro.44 fighter with wings folded.

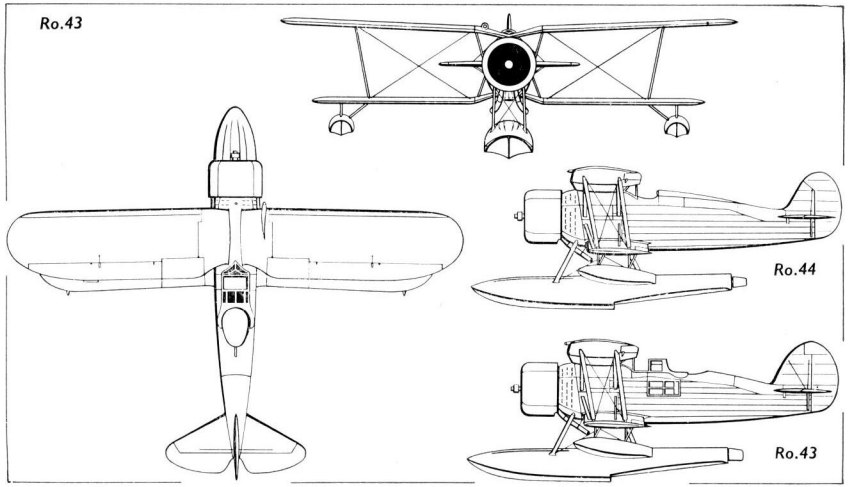
the standard shipboard type throughout the thirty-nine months in which Italy fought as a partner in the Axis, and when the Armistice was signed on September 8, 1943, there were still twenty-eight Ro.43s aboard various warships, although only eighteen of these were serviceable, eleven were attached to the 2ª *Squadriglia Forze Navali*, none of which were serviceable, and a further nine were attached to the 3ª *Squadriglia Forze Navali*, only four of these being serviceable.

The last float fighter to serve with the Regia Aeronautica, the Ro.44 was a straightforward single-seat conversion of the Ro.43, the only changes being the deletion of the observer's cockpit and side windows and the replacement of the forward-firing 7.7-mm. gun by twin 12.7-mm. weapons. First flown in 1936, the Ro.44 equipped one *Gruppo* and one *Squadriglia Caccia Marittima* on November 1, 1939, but when Italy entered the war only the 161ª *Squadriglia Caccia Marittima* based on the island of Lero in the Aegean was equipped entirely with the Ro.44, possessing eight of the remaining twenty-five machines of this type. The operational area of the unit was

restricted to the Aegean, but by November 9, 1940, only four Ro.44s remained serviceable, and on June 11, 1941, the *Squadriglia* was disbanded, being reformed on C.R.42 Falcos. A few Ro.44s survived until the Armistice at which time three fighters of this type were attached to each of the 2ª and 3ª *Squadriglie Forze Navali*.

The following specification relates to the Ro.43, data quoted in parentheses relating specifically to the Ro.44.

Type: *Two (Single) Seat Reconnaissance (Fighter) Single-float Seaplane.* **Power Plant:** *One* 700 *h.p. Piaggio P.X R nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 7.7-*mm. Breda-SAFAT machine gun and one similar gun on flexible mount (Two fixed forward-firing* 12.7-*mm. Breda-SAFAT machine guns).* **Performance:** *Maximum speed,* 174 *m.p.h. at sea level,* 186 (193) *m.p.h. at* 8,200 *ft.; economical cruising speed,* 112 (117) *m.p.h.; maximum cruising speed,* (149) *m.p.h.; climb to* 13,120 *ft.,* 11 *min.* (8 *min.* 40 *sec.*), *to* 16,400 *ft.,* 15 *min.* 50 *sec.* (12 *min.* 30 *sec.*); *service ceiling,* 21,650 *ft.; maximum ceiling,* 22,965 *ft.; normal range,* 497 (298) *mls.; maximum range,* 932 (745) *mls.; normal endurance,* 4 *hr.* 30 *min.* (2 *hr.*). **Weights:** *Empty,* 3,924 (3,682) *lb.; loaded,* 5,291 (4,898) *lb.* **Dimensions:** *Span,* 37 *ft.* 11⅝ *in.; length,* 31 *ft.* 10½ *in.; height,* 11 *ft.* 6⅛ *in.; wing area,* 359.084 *sq. ft.*



AICHI E13A1 (JAKE)

JAPAN

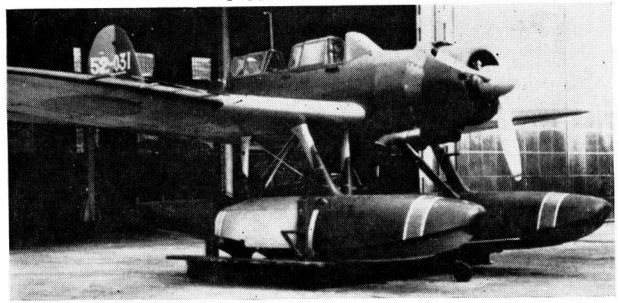
Manufactured in larger numbers than any other Japanese floatplane, the E13A1 was a 12-*Shi* aircraft meeting a specification issued in 1937 and calling for a high-performance three-seat long-range reconnaissance aircraft suitable for use both from catapults and from shore bases. Aichi's design, known as the AM-19 and produced by Kishiro Matsuo assisted by Morishige Mori and Yasushiro Ozawa, was based broadly on the earlier and unsuccessful 12-*Shi* E12A1, and the first prototype was flown in 1938. After official evaluation trials, the AM-19 was accepted for production in December 1940 as the E13A1 Type O Reconnaissance Seaplane Model 1 (later Model 11).

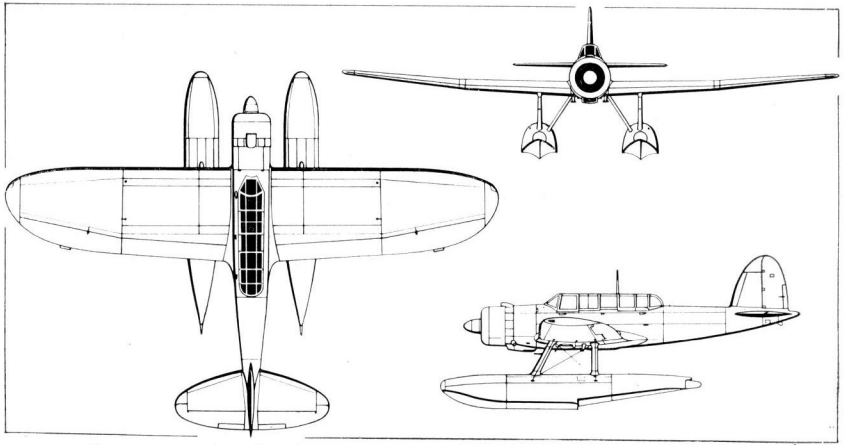
The E13A1 was of all-metal construction with two long single-step floats each attached to the wing centre section by a pair of vertical struts. Power was provided by an MK8 Kinsei 43 fourteen-cylinder radial rated at 1,080 h.p. at 6,560 ft., and the E13A1 made its operational début late in 1941 as a successor to the ageing E7K1 on the China front where, launched from seaplane tenders and cruisers, it was used for attacks on the Canton-Hankow railway. E13A1 floatplanes from the cruisers *Chikuma*, *Kinugasa* and *Tone* supplied the information concerning the disposition of the U.S. Pacific Fleet in Pearl Harbour on which the J.N.A.F. acted for its surprise attack on the naval base, and made first contact with U.S. naval forces in Coral Sea and Midway battles.

A dual-control training variant of the floatplane was designated E13A1-K, but the parent company produced only 133 E13A1s, including prototypes, owing to the need to concentrate on production of the D3A and D4Y dive bombers, and production of the floatplane was transferred to Kyushu (Watanabe until its reorganisation in 1943) who produced 1,127 machines, and to the 11th Naval Air Arsenal at Hiro where approximately ninety additional E13A1s were built.

A modified version of the basic design, the E13A1a Type O Reconnaissance Seaplane Model 11A appeared in 1944 and was accepted in November of that year. Similarly powered to the E13A1, the E13A1a had different radio equipment (Ku Mk.6 Airborne Radio Model 4), but the principal change was to be seen in the bracing of the floats. Two additional pairs of inwardly-sloping struts connecting with the centre section were employed and many of the bracing wires deleted. At the same time another version of the floatplane was introduced, this being the E13A1b which was similar to the A1a apart from having airborne search radar. Several modified versions of the E13A1a and A1b were subsequently introduced, including a night reconnaissance model with extended flame-damping exhaust stacks, an anti-submarine version equipped with magnetic anomaly detection gear, and an anti-patrol boat model with a flexible 20-mm. cannon mounted to fire from the fuselage belly.

An Aichi A13A1b equipped with airborne search radar.





The E13A1 was extremely popular with its crews who preferred it to the more powerful Zui-un, and among the tasks performed by this floatplane in addition to its primary role of reconnaissance were air-sea rescue, liaison, coastal patrol, convoy escort and shipping attack. It remained in active service throughout the Pacific War.

Type: *Three-seat Long-range Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 1,080 *h.p. Mitsubishi MK*8 *Kinsei* 43 *fourteen-cylinder radial air-cooled engine.* **Armament:** *One flexible* 7.7-*mm. machine gun and one* 550-*lb. bomb or four* 132-*lb. bombs.* **Performance:** *Maximum speed,* 234 *m.p.h. at* 7,150 *ft.; cruising speed,* 138 *m.p.h. at* 6,560 *ft.; time to* 9,840 *ft.,* 5 *min.* 27 *sec., to* 16,400 *ft.,* 8 *min.* 32 *sec.; service ceiling,* 26,100 *ft.; normal range,* 700 *mls.; maximum range,* 1,116 *mls.; endurance,* 9.4-14.9 *hr.* **Weights:** *Empty,* 5,564-5,824 *lb.; normal loaded,* 8,047 *lb.; maximum,* 8,818 *lb.* **Dimensions:** *Span,* 47 ft. 6¾ *in.; length,* 36 *ft.* 11⅝ *in.; height,* 15 *ft.* 8⅛ *in.; wing area,* 427 *sq. ft.*

AICHI E16A1 ZUI-UN (PAUL) JAPAN

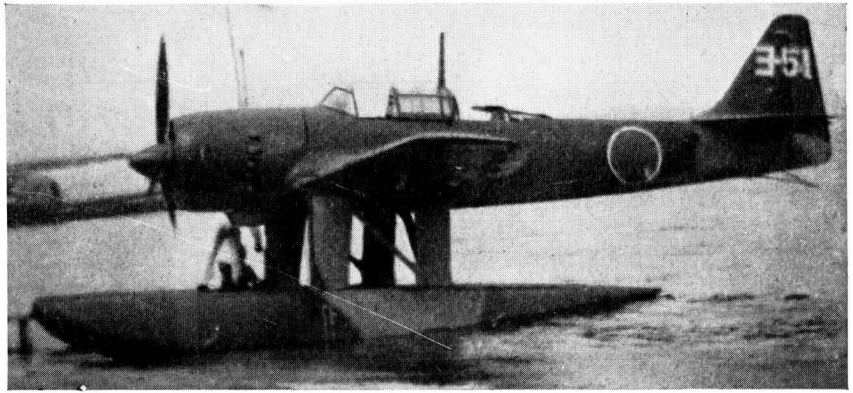
Carrying an appreciably heavier defensive armament than other Japanese reconnaissance float seaplanes, the Zui-un (Auspicious Cloud) was produced to meet a 14-*Shi* requirement for a two-seat reconnaissance floatplane possessing dive-bombing capability. The Aichi Kokuki K.K. began work on the Zui-un as the AM-22 in October 1940, Kishiro Matsuo being chief designer and Yasushiro Ozawa being in charge of aerodynamic design. Changes in the specification during design resulted in the Zui-un being redesignated a 16-*Shi* type, and as the E16A1 the first of three prototypes flew in May 1942.

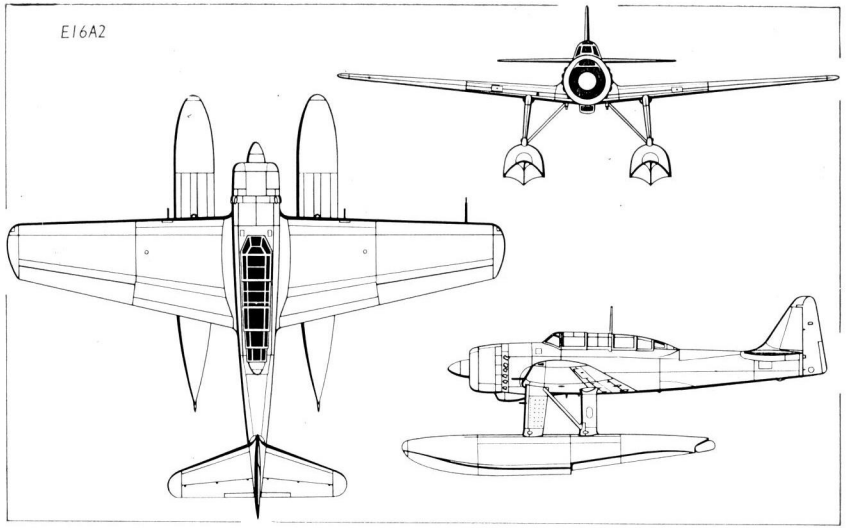
The E16A1 was of all-metal construction apart from detachable wooden wingtips and a wooden tailplane. The twin single-step floats were attached to the wings by vertical N-struts, the rear struts being braced to the underside of the fuselage by inclined struts, and hinged to the trailing edges of the front vertical struts were hydraulically-operated double-acting dive brakes. The prototypes were powered by the Kinsei 51 fourteen-cylinder radial air-cooled engine rated at 1,300 h.p. for take-off, and defensive armament comprised two wing-mounted 7.7-mm. machine guns and one 7.7-mm. gun on a flexible mount in the observer's cockpit.

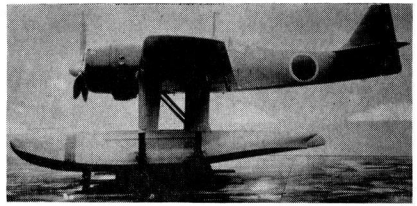
From the outset of flight testing troubles were experienced with the dive brakes, severe vibration and buffeting being experienced immediately these were extended. This problem was eventually surmounted by introducing perforated brakes, but the prototypes spent extensive periods on the ground undergoing modifications, these changes seriously delaying the test programme. The planing bottoms of the floats were found to need strengthening, poor longitudinal stability had to be rectified, the double-acting Fowler-type flaps between the ailerons and the fuselage tended to malfunction and had to be modified, and maintenance accessibility had to be improved, and it was not until August 1943 that the J.N.A.F. accepted the E16A1 for production as the Zui-un Model 11. The production model differed from the prototypes in having a Kinsei 54 engine and defensive armament increased to two 20-mm. wing-mounted cannon and one flexible 12.7-mm. machine gun, and the Zui-un made its operational début in the Philippines where it served in both the dive-bombing and reconnaissance roles. Initially, the Zui-un provided a number of maintenance problems, but these were gradually eradicated, and the aircraft established a reputation for reliability.

Aichi produced a total of 194 Zui-un floatplanes, but towards the end of 1944 production was transferred to Nippon Hikoki K.K. owing to the parent company concentrating on the production of the D4Y Suisei land-based dive-bomber. Nippon only succeeded in com-

The E16A1 Zui-un carried a substantially heavier defensive armament than earlier floatplanes.







The third prototype Zui-un floatplane.

pleting fifty-nine Zui-un aircraft owing to the fact that the bulk of the company's labour force comprised unskilled student workers, production rate being as low as ten per month. In 1945, a more powerful version of the floatplane, the E16A2 Zui-un Model 12 powered by the Kinsei 62, but this model was still in the flight test stage when hostilities terminated, and most of the surviving E16A1 aircraft were used in the *Kamikaze* role in the Okinawa area during the closing phases of the Pacific War.

Type: *Two-seat Reconnaissance and Dive Bomber Twin-float Seaplane.* **Power Plant:** *One* 1,300 *h.p. Mitsubishi Kinsei* 54 *fourteen-cylinder radial air-cooled engine.* **Armament:** *Two fixed forward-firing* 20-*mm. cannon and one flexible* 12.7-*mm. machine gun, plus one* 550-*lb. bomb or two* 132-*lb. bombs.* **Performance:** *Maximum speed,* 273 *m.p.h. at* 17,900 *ft.; cruising speed,* 219 *m.p.h. at* 16,400 *ft.; time to* 9,840 *ft.,* 4 *min.* 4 *sec., to* 16,400 *ft.,* 9 *min.* 59 *sec.; service ceiling,* 32,800 *ft.; normal range,* 353 *mls.; maximum range,* 810 *mls.* **Weights:** *Empty,* 6,393 *lb.; normal loaded,* 8,598 *lb.; maximum,* 9,920 *lb.* **Dimensions:** *Span,* 42 *ft.* 0¼ *in.; length,* 35 *ft.,* 6⅓ *in.; height,* 15 *ft.,* 8½ *in.; wing area,* 301.389 *sq. ft.*

AICHI M6A1 SEIRAN

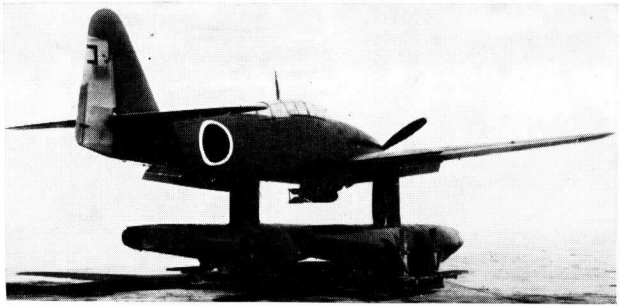
JAPAN

Shortly before the beginning of the Pacific War, plans were prepared for the construction of eighteen extremely large I-400 class submarines which, each displacing 4,500 tons, were to have a cruising radius of 41,575 nautical miles at fourteen knots. Each I-400 class submarine was to embody a cylindrical watertight hangar capable of accommodating two (later increased to three) attack aircraft for surprise attacks on strategic targets far outside the normal radius of action of Japanese naval aircraft. The aircraft were to be launched from the submarines by catapult and after completing their mission were to land near the submarines which would then take off the crews, the aircraft themselves being abandoned.

A 17-*Shi* specification for a suitable aircraft was prepared by the Japanese Navy and issued to Aichi, the utmost secrecy being observed. Aichi's design team, headed by Norio Ozaki who was assisted by Morishige Mori and Yasushiro Ozawa, collaborated extremely closely with the Japanese Navy, and the special attack aircraft was designated M6A1 Seiran (Mountain Haze). Initially, the Seiran was considered purely as a catapult-launched aircraft without an undercarriage, but this concept changed as design work progressed, detachable floats being introduced. Simultaneously, a training variant with a retractable undercarriage was evolved, the M6A1-K Seiran-Kai, but later this version was allocated a new popular name, being known as the Nanzan (Southern Mountain), this name also being applied to the catapult-launched undercarriage-less version.

The design of the M6A1 was initiated in June 1942, the aircraft being of all-metal

construction and the wings swivelling on the rear spar at the roots to lie flat along the fuselage sides for stowage in the submarine's hangar. The tip of the rudder folded to starboard and the horizontal tail surfaces folded downwards at roughly quarter-span. The wings were extended hydraulically, and it took four trained personnel approximately six minutes to prepare the aircraft for launching from the moment the power-driven hangar doors were opened. The first prototype M6A1 was completed in November 1943, this being powered by a 1,400 h.p. Aichi Atsuta 21 liquid-cooled engine, and seven further prototypes were built, these being similarly powered. The production model differed from the prototypes principally in having the Atsuta 32 engine which, offering a similar maximum output for take-off, gave 1,340 h.p. at 5,580 ft. as compared with 1,250 h.p. from the earlier power plant.

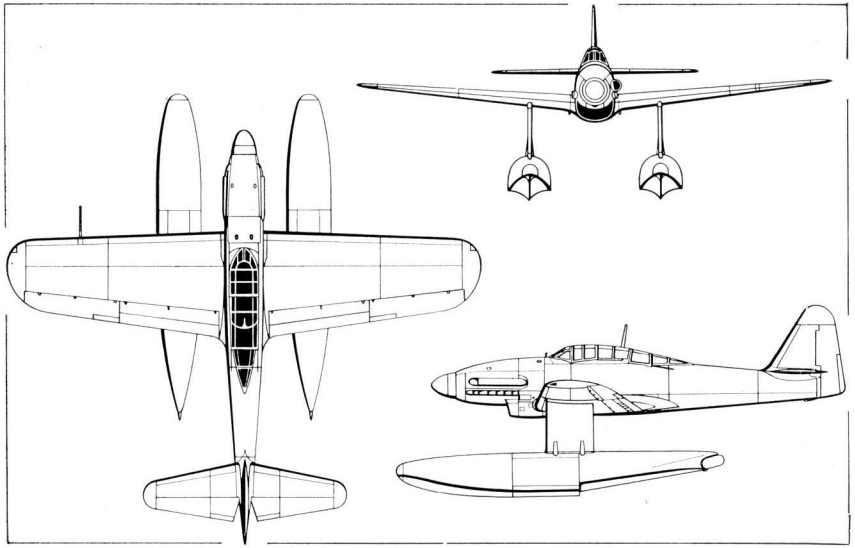


The fifth prototype M6A1 Seiran submarine-borne attack aircraft.

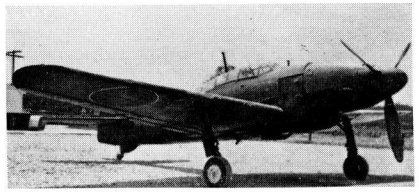
Numerous difficulties were being encountered in the construction of the I-400 submarines while the M6A1 was under development, and as a result of the delay several 3,600-ton I-13 class submarines were converted to carry two M6A1s each, and together with ten Seiran floatplanes four converted I-13 class submarines equipped the 1st Submarine Flotilla early in 1945. From the outset of development of the M6A1 the Japanese Navy had nurtured the idea of employing this aircraft for an attack on the Panama Canal with the aim of blocking this vital supply artery. The plan called for the launching of the M6A1s, each carrying a 1,760-lb. bomb, from the submarines cruising within range of the canal. The crews that were to undertake the attack underwent intensive training, using large-scale models of the canal zone, but by the time this daring attack was virtually ready for launching, the Pacific War was drawing to a close and the target of the attack was changed to the Uliti Atoll. This operation was scheduled to take place in July 1945, the earliest that the 1st Submarine Flotilla could be readied for the attack, but before the sortie could be attempted the Japanese government had capitulated.

A total of twenty production M6A1 aircraft was completed during 1944-45, a few of these having retractable wheel undercarriages as M6A1-K Nanzans for training and the remainder having provision for detachable floats.

Type: *Two-seat Attack Bomber (Detachable) Twin-float Seaplane.* **Power Plant:** *One* 1,400



(*Below*) *The M6A1-K Nanzan.*



h.p. Aichi Atsuta 32 twelve-cylinder inverted-Vee liquid-cooled engine. **Armament:** *One 12.7-mm, machine gun and two 550-lb. bombs or one 1,760-lb. bomb.* **Performance:** *Maximum speed, 295 m.p.h. at 17,060 ft.; economical cruising speed, 184 m.p.h. at 9,840 ft.; time to 9,840 ft., 5 min. 48 sec.; service ceiling, 32,480 ft.; range, 739 mls.* **Weights:** *Empty, 7,412 lb.; normal loaded, 9,370 lb.; maximum, 10,803 lb.* **Dimensions:** *Span, 40 ft. 2⅔ in.; length, 38 ft. 2¼ in.; height, 15 ft. 0⅓ in.; wing area, 290.626 sq. ft.*

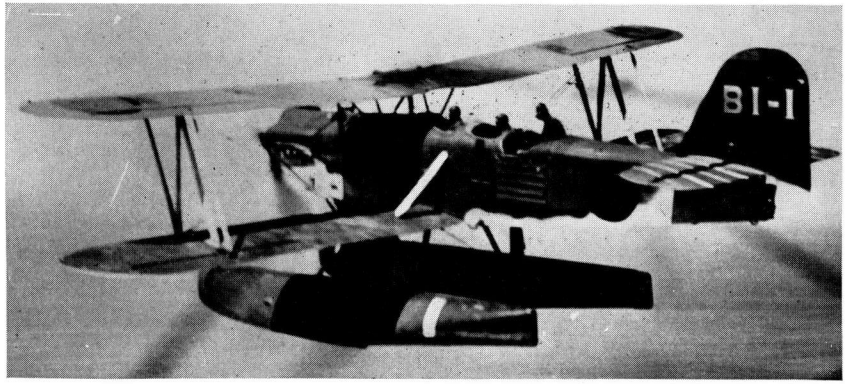
KAWANISHI E7K1 AND E7K2 (ALF)

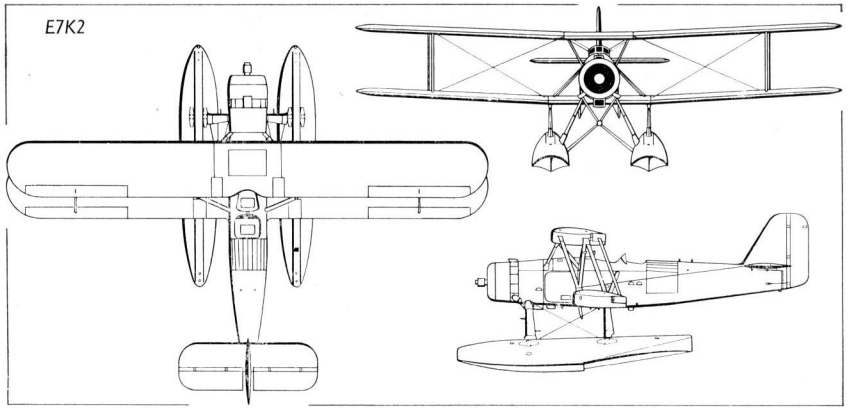
One of the most venerable float seaplanes to see any extensive service with the J.N.A.F during the Pacific War was Kawanishi's Type 94 Reconnaissance Seaplane which stemmed from a 7-*Shi* specification issued to Aichi and Kawanishi in 1932. The Kawanishi design team headed by Eiji Sekiguchi began work on a fabric-covered all-metal twin-float biplane in March 1932, the design being designated Model J by the company. The first prototype was flown on February 6, 1933, and was delivered to the J.N.A.F. for evaluation during the following May, quickly proving its overall superiority to the competitive Aichi AB-6. A second prototype was completed, and before the end of 1933, the aircraft had been ordered into production as the Type 94 Reconnaissance Seaplane, entering service in 1935 with a 500 h.p. Hiro Type 91 liquid-cooled inline engine.

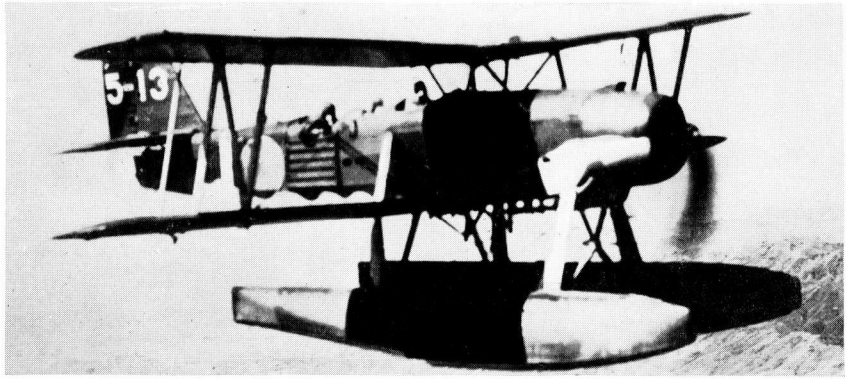
The Type 94, or E7K1, possessed exceptionally fine characteristics and soon established an excellent reputation, and an aircraft of this type was flown non-stop between Yokosuka and Bangkok by Lieut. Com. Nitta of the J.N.A.F. Later production machines were powered by an up-rated Type 91 engine of 600 h.p., and 183 E7K1 floatplanes were produced between 1934 and 1938, fifty-seven of these being built by Nippon Hikoki K.K. (Nihon).

In August 1938, the design gained a new lease on life with the appearance of the E7K2 which differed from its predecessor primarily in having the Hiro Type 91 engine supplanted by an 870 h.p. Mitsubishi MK2 Zuisei 11 fourteen-cylinder radial air-cooled engine, this being installed in the 184th production Type 94 Reconnaissance Seaplane. Production was undertaken by both Kawanishi and Nippon

The E7K1 was phased out of operational service shortly before the beginning of the Pacific War.







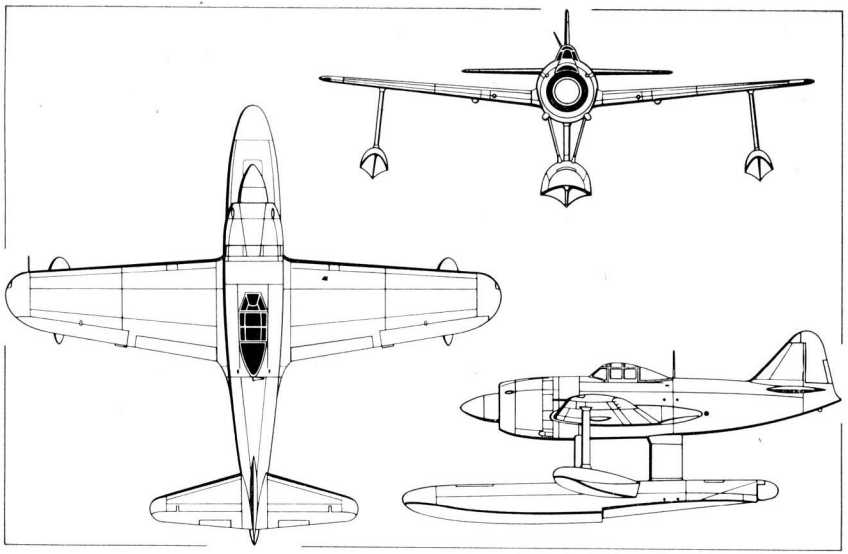
Hikoki, a total of 347 examples of the radial-engined version having been built when production terminated early in 1941. The E7K2 retained the excellent control characteristics and seaworthiness of the E7K1 but offered an appreciably improved performance, and it was used widely for reconnaissance both from the catapults of warships and from shore bases, for liaison, for anti-submarine patrols and for escorting convoys in the vicinity of the Japanese home islands. It was the standard catapult-launched reconnaissance type aboard *Atago* and *Nachi* class cruisers, and versions were produced as radio-controlled target aircraft and as a drone target carrier aircraft, acting as a parent for the MXY3 and MXY4 targets. The earlier E7K1 had been phased out of operational service shortly before the beginning of the Pacific conflict and assigned to training duties, although later it was to see operational service in the closing stages of the war when it served as a *Kamikaze* type. The E7K2 was also progressively replaced by the Aichi E13A1 during the first year of the Pacific War and relegated to the training role until it saw service in the *Kamikaze* role.

Type: *Three-seat Shipboard Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 870 *h.p. Mitsubishi MK2 Zuisei* 11 *fourteen-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing and two flexible* 7.7-*mm. machine guns and four* 132-*lb. bombs.* **Performance:** *Maximum speed,* 171 *m.p.h at* 6,560 *ft.; cruising speed,* 115 *m.p.h. at* 3,280 *ft.; time to* 9,840 *ft.,* 9 *min.* 6 *sec.; service ceiling* 23,160 *ft.; range,* 1,147 *mls.* **Weights:** *Empty,* 4,375 *lb.; loaded,* 6,614 *lb.* **Dimensions:** *Span,* 45 *ft.* 11⅛ *in.; length,* 34 *ft.* 5⅓ *in.; height,* 14 *ft.* 11⅛ *in.; wing area,* 469.306 *sq. ft.*

KAWANISHI N1K1 KYOFU (REX) — JAPAN

Faced with the possibility of future operations in the Pacific, early in 1940 the Japanese Navy prepared a specification for a water-based fighter to provide air cover during amphibious landing operations prior to the capture of airfields by the ground forces. Nakajima was assigned the responsibility of producing an interim float fighter based on Mitsubishi's A6M2 Zero-Sen, and Kawanishi was awarded a development contract for what was intended to be the most powerful and advanced floatplane fighter in the world. The specification was issued to Kawanishi in September 1940, and design work was begun immediately on the 15-*Shi* fighter, or K-20 as it was designated by the company, the design team including Shizuo Kikuhara, Toshiharu Baba, Elizaburo Adachi and Hiroyuki Inoue.

Eighteen months elapsed before the first prototype was completed at Kawanishi's Naruo plant, and flown for the first time on May 6, 1942, it was immediately obvious tha-the new fighter possessed considerable potent tial. The K-20 was powered by a special model of the Mitsubishi Kasei (Mars) fourteen-cylinder radial air-cooled engine, the MK4D Kasei 14 geared for contra-rotating airscrews. The use of contraprops was considered necessary in order to offset the airscrew torque anticipated with such a powerful engine mounted in a relatively short fuselage and resulting tendency to snake during take-off. A mid-wing configuration had been adopted to clear the water spray during take-off and landing, and a laminar flow aerofoil section evolved by Professor Ichiro Tani of the Tokyo Imperial Universityhad been chosen for the wing after extensive wind tunnel tests. The original



plans had called for retractable stabilising floats, but retraction was abandoned in view of its increased weight and complexity, fixed floats each with a single slim cantilever strut being standardised.

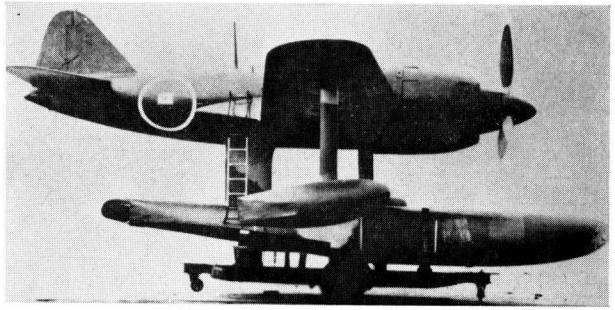
From the outset of flight trials it was found that the complexities of the gearing necessitated by the contra-props outweighed any advantages that these airscrews offered, and the second prototype was modified to take the Kasei 13 engine which was similar to the Kasei 14 but drove a single three-bladed airscrew via an extension shaft. The second prototype was completed in October 1942, and it was found to suffer seriously from the snaking during the take-off run that the contra-props had been intended to safeguard against. It was found to call for extreme skill in correcting for torque, especially during take-off, and the aircraft was seriously damaged during one of its first landings when the pilot over-corrected. However, four further prototypes had been completed by the end of the year, these being joined in the test programme by

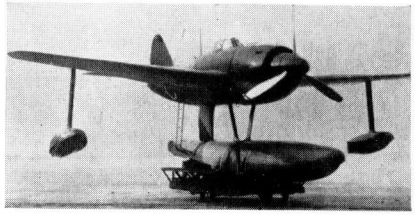
two more prototypes at the beginning of 1943, and the most serious shortcomings of the design were progressively eliminated, although the fighter was always to demand considerable skill in taking-off and landing.

In December 1942, the K-20 was accepted by the J.N.A.F. for production as the N1K1 Kyofu (Mighty Wind) Floatplane Fighter Model 11, and Kawanishi's Naruo and Himeji plants began tooling up to build the aircraft as a replacement for the interim Nakajima A6M2-N. Production started slowly but began to gain tempo in June 1943, reaching a production peak in the following December in which month fifteen Kyofu fighters were delivered to bring deliveries to eighty-nine aircraft excluding prototypes in that year. By that time, however, the war situation had changed, and the J.N.A.F. was no longer faced by mediocre land-based Allied fighters, and a floatplane fighter, no matter how exceptional its performance had little chance of successfully opposing the newer Allied land-based fighters. The Kyofu was allocated to operational units as a replacement for the A6M2-N as rapidly as possible, and a number were sent to the South Pacific, but their operations were somewhat restricted owing to the radically changing combat conditions. They were used in the interception role at Balikpapan in the Dutch East Indies where they proved themselves to be rugged and highly efficient aircraft.

At the beginning of 1944, production of the Kyofu was tapered off in order to enable both the Naruo and Himeji plants to concentrate on a landplane derivative of the design, the N1K1-J Shiden (see pages 4-6, Volume III) terminating in March with the ninety-seventh machine. During the closing stages of the war, some Kyofu floatplanes were assigned to the Ohtsu Naval Air Corps, operating from Lake Biwa on the Japanese home island of Honshu. Late production examples of the Kyofu were powered by the MK4E Kasei 15 which differed only in minor details from the Kasei 13, and at the time production was halted, an advanced model known as the N1K2 Kyofu-Kai was in the development stage, this model having the Mitsubishi MK4R Kasei 23 rated at 1,900 h.p.

Type: *Single-seat Interceptor Fighter Float Seaplane.* **Power Plant:** *One* 1,460 *h.p. Mitsubishi Kasei* 13 *fourteen-cylinder radial air-cooled engine.* **Armament:** *Two* 7.7-*mm. Type* 97 *machine guns and two* 20-*mm. Type* 99 *cannon.* **Performance:** *Maximum speed,* 302 *m.p.h. at* 18,700 *ft.; cruising speed,* 230 *m.p.h. at* 13,120 *ft.; time to* 16,400 *ft.,* 5 *min.* 32 *sec.;*





The N1K1 Kyofu was allocated to operational units as a replacement for the A6M2-N.

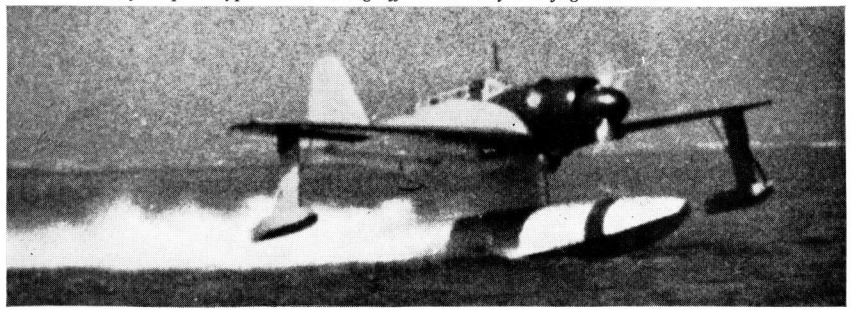
service ceiling, 34,645 *ft.; normal range*, 656 *mls.; maximum range*, 1,036 *mls.; normal endurance*, 2.9 *hr.; maximum endurance*, 4.8 *hr.* **Weights:** *Empty*, 6,063 *lb.; loaded*, 7,716 *lb.; maximum*, 8,183 *lb.* **Dimensions:** *Span*, 39 *ft.* 4½ *in.; length*, 34 *ft.* 8¾ *in.; height*, 15 *ft.* 8⅛ *in.; wing area*, 252.952 *sq. ft.*

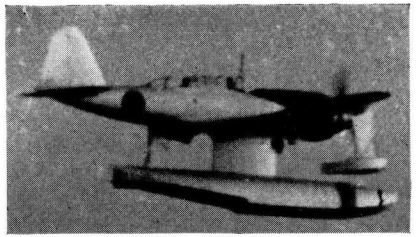
KAWANISHI E15K1 SHIUN (NORM) JAPAN

The last float seaplane to be produced by the Kawanishi Kokuki K.K., the radical Shiun (Violet Cloud) was designed to undertake reconnaissance missions in areas where aerial supremacy was held by the enemy, the primary requirement thus being speed. This 14-*Shi* specification was only issued to Kawanishi whose design team began work on the project in July 1939.

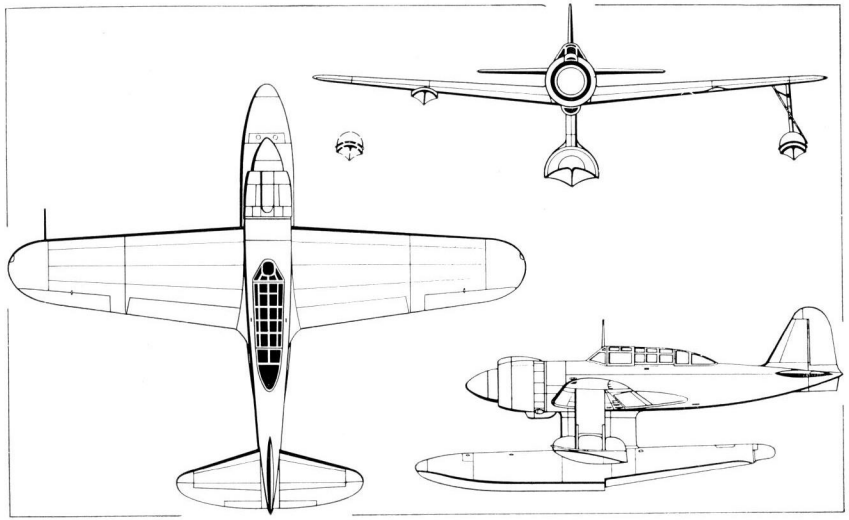
From the outset of design work the aim was to produce a floatplane faster than land-based aircraft that it was likely to encounter, and which could, therefore, rely on its speed for protection. Of all-metal construction, the Shiun employed an LB laminar flow aerofoil which had been evolved by Professor Ichiro Tani of the Tokyo Imperial University. The outboard stabilising floats were unique in having metal planing bottoms and rubberised-fabric tops which were inflated when the floats were extended. For retraction the floats were deflated by vacuum pumps so that only the planing bottoms projected beneath the wing undersurfaces. The cantilever pylon-mounted central float could be jettisoned in an emergency, more speed thus being gained in order to elude pursuing enemy fighters. The float pylon was attached to the fuselage by means of two pins. The fore pin could be removed by means of a lever in the pilot's cockpit, the aft pin thereupon being forced free by the air pressure. The jettisonable float scheme was adopted after extensive wind tunnel tests had proved that the float would not hit the fuselage or wing after being jettisoned, although, in the event, no full-scale tests had been undertaken when the Shiun entered service. The Mitsubishi Kasei 14 (MK4D) fourteen-cylinder radial engine rated at 1,620 h.p. for take-off

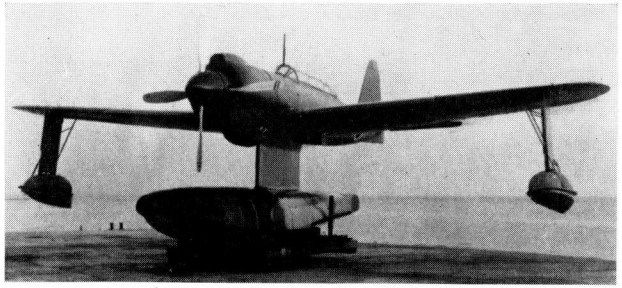
The first prototype Shiun taking-off on an early test flight in October 1942.





The first prototype Shiun in flight.





A production E15K1 Shiun reconnaissance floatplane.

was fitted with two-blade contra-rotating airscrews, the first of their type to be tested in Japan, the front blades rotating in a clockwise direction and the aft blades rotating counter-clockwise.

The first prototype Shiun, which bore the manufacturer's designation K-10, was completed in October 1942, but was heavily damaged at the beginning of its flight trials when, during a landing, malfunctioning of the flaps resulted in the stabilising floats being torn off. The aircraft was then completely dismantled, a new engine installed and a ventral fin added beneath the rear fuselage. Prior to being dubbed Shiun, the E15K1 had entered production as the Type 2 High-speed Reconnaissance Seaplane Model 11, and five additional aircraft had been completed by the end of 1942. A series of accidents were experienced with the stabilising floats during subsequent trials, the inflation and deflation system proving extremely unreliable, and on occasions the floats were retracted inadvertently during a landing. The float shape was therefore modified and the inflation system eliminated, but the retraction system was also troublesome and, finally, was also eliminated, the stabilising floats being fixed and attached to the wings by slim cantilever struts.

Four Shiun floatplanes had been passed to the J.N.A.F. for evaluation by the end of 1942, a further eight were delivered during 1943, and the last three aircraft of this type were handed over in January-February 1944, quantity production having been cancelled. The reason for this cancellation was the disappointing result of service testing. Six Shiun reconnaissance aircraft had been sent to Palau in the South Pacific, but it had been found that the central float could not be jettisoned as easily as had been supposed, and with the float attached the maximum speed of 292 m.p.h. was insufficient to enable the Shiun to elude enemy fighters. The single 7.7-mm. machine gun installed for defensive purposes was totally inadequate, and all six machines had been quickly lost to Allied fighters.

Type: *Three-seat Reconnaissance Float Seaplane.* **Power Plant:** *One* 1,850 *h.p. Mitsubishi MK4S Kasei* 24 *fourteen-cylinder radial air-cooled engine.* **Armament:** *One* 7.7-*mm. machine gun.* **Performance:** *Maximum speed,* 291 *m.p.h. at* 18,700 *ft.; cruising speed,* 184 *m.p.h. at* 8,200 *ft.; time to* 19,685 *ft.,* 10 *min.; service ceiling,* 32,250 *ft.; range,* 2,095 *mls. at* 184 *m.p.h. at* 8,200 *ft.* **Weights:** *Empty,* 6,978 *lb., normal loaded,* 9,039 *lb.; maximum,* 10,803 *lb.* **Dimensions:** *Span,* 45 *ft.* 11⅛ *in.; length,* 38 *ft.* 0⅛ *in.; height,* 16 *ft.* 2¼ *in.; wing area,* 322.9 *sq. ft.*

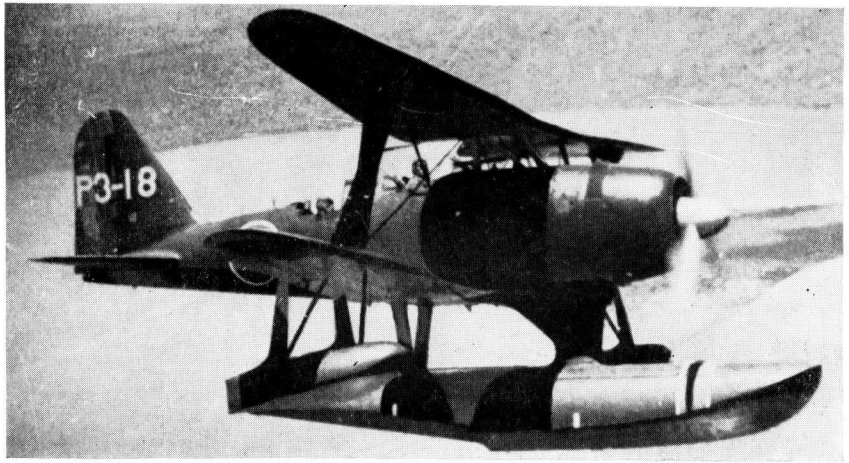
MITSUBISHI F1M2 (PETE) JAPAN

Characterized by its exceptional manoeuvrability, the F1M2 or Type O Observation Seaplane Model 11 was active throughout the Pacific War and, although designed solely for the short-range observation role, it fulfilled many tasks during its operational career, including those of reconnaissance-bomber, anti-shipping aircraft, coastal patrol and convoy escort aircraft, and even, on occasions, that of interceptor fighter.

Designed to compete for J.N.A.F. orders against tenders from the Aichi and Kawanishi companies to meet the requirements of a 10-*Shi* observation seaplane specification issued in 1934 and intended to provide a successor to the Nakajima E8N1 aboard catapult-equipped battleships and cruisers. Bearing the company designation Ka-17, the Mitsubishi contender was designed under the supervision of Joji Hattori who endeavoured to attain a high standard of aerodynamic cleanliness by severely restricting the number of interplane struts and the amount of wire bracing, and the first of four prototypes officially designated F1M1 was flown in June 1936.

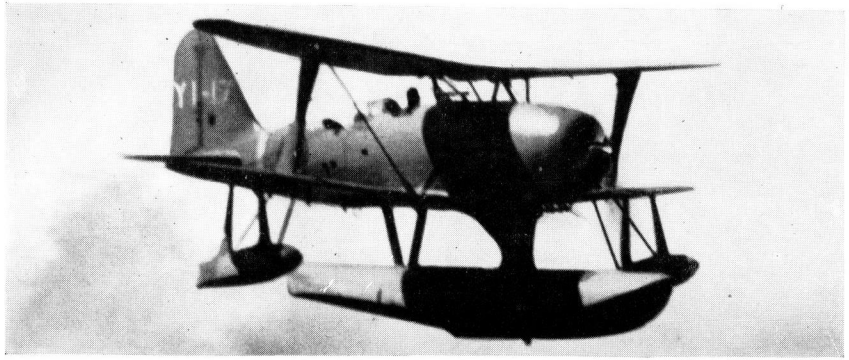
The F1M1 was powered by an 820 h.p. Hikari 1 radial air-cooled engine and was of all-metal construction. The fuselage employed

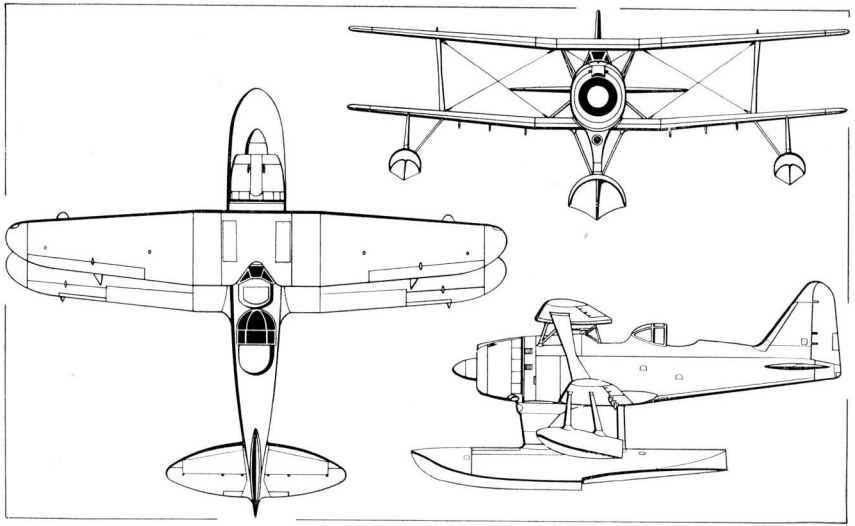
One of the most versatile of Japan's floatplanes, the F1M2, was exceptionally manoeuvrable.



a steel-tube forward section and a monocoque rear section, the wings, which had single interplane struts, were of elliptical form, and the central float, which was essentially similar to that of the E8N1, was pylon-mounted forward of the lower wing with splayed side-by-side struts under the centre-section trailing edge. During trials at Nagoya the F1M1 was found to possess poor directional stability, it was unstable on the water, and there was a marked tendency towards auto-rotation. Therefore, wing dihedral was increased from two to three degrees, the area of the vertical fin was increased by eighty-five per cent and that of the rudder was increased by thirty per cent. Simultaneously, the central and wingtip floats were enlarged to increase buoyancy on the water, and the wing was redesigned, a straight-tapered form being adopted. With these modifications the characteristics of the F1M1 were markedly improved, and with the replacement of the Hikari engine in August 1938 by the Mitsubishi MK2 Zuisei 13, the floatplane passed official acceptance trials and was ordered into production as the F1M2, or Type O Observation Seaplane Model 11.

The F1M2 entered service with the J.N.A.F. in 1941 and participated in almost every major campaign from the beginning of the Pacific War, operating from shore bases and seaplane tenders. The exceptional manoeuvrability of the F1M2 and its high climb rate resulted in its use as a fighter during the early stages of the war in the Philippines, New Guinea and Solomons areas, the floatplanes operating from seaplane tenders of the 11th Air Division. After the occupation of Attu in the Aleutians in June 1942, a fighter squadron was formed with F1M2s on the island. The armament of the F1M2 comprised two fixed forward-firing 7.7-mm. machine guns and one similar weapon on a flexible mount in the observer's cockpit. Two 132-lb. bombs could be carried on racks under the wing centre section, and the aircraft was experimentally tested with one 550-lb.





bomb.

Widely used for anti-submarine patrol, convoy escort and gunnery observation until the end of the war, the F1M2 was built both by the parent company and by the Sasebo Air Arsenal, Mitsubishi completing 524 machines by the time production terminated in March 1944, and Sasebo adding approximately 180 aircraft to this total.

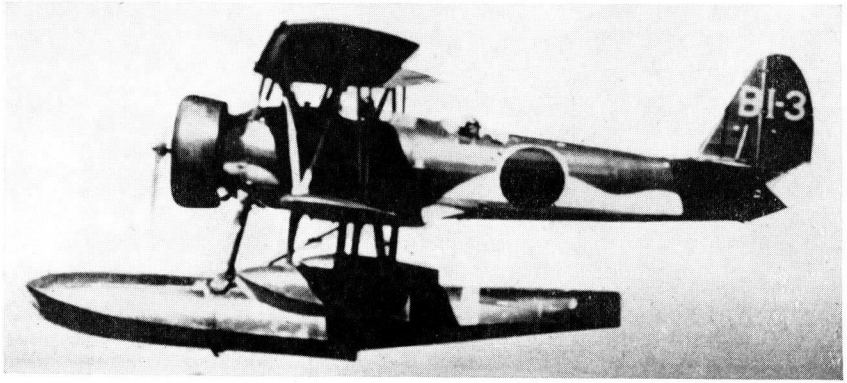
Type: *Two-seat General-purpose Float Seaplane.* **Power Plant:** *One* 875 *h.p. Mitsubishi MK2 Zuisei* 13 *fourteen-cylinder radial air-cooled engine.* **Armament:** *Two fixed forward-firing* 7.7-*mm. machine guns and one flexible* 7.7-*mm. gun, plus two* 132-*lb. bombs.* **Performance:** *Maximum speed,* 230 *m.p.h. at* 11,290 *ft.; economical cruising speed,* 127 *m.p.h.; time to* 9,840 *ft.,* 5 *min.* 4 *sec., to* 16,400 *ft.,* 9 *min.* 36 *sec.; service ceiling,* 30,970 *ft.; range,* 276 *mls. at* 127 *m.p.h. at* 3,280 *ft.; maximum range,* 360 *mls.* **Weights:** *Empty,* 4,330 *lb.; loaded,* 5,622 *lb.; maximum,* 6,296 *lb.* **Dimensions:** *Span,* 26 *ft.* 1 *in.; length* 31 *ft.* 2 *in.; height,* 13 *ft.* 1½ *in.; wing area* 317.965 *sq. ft.*

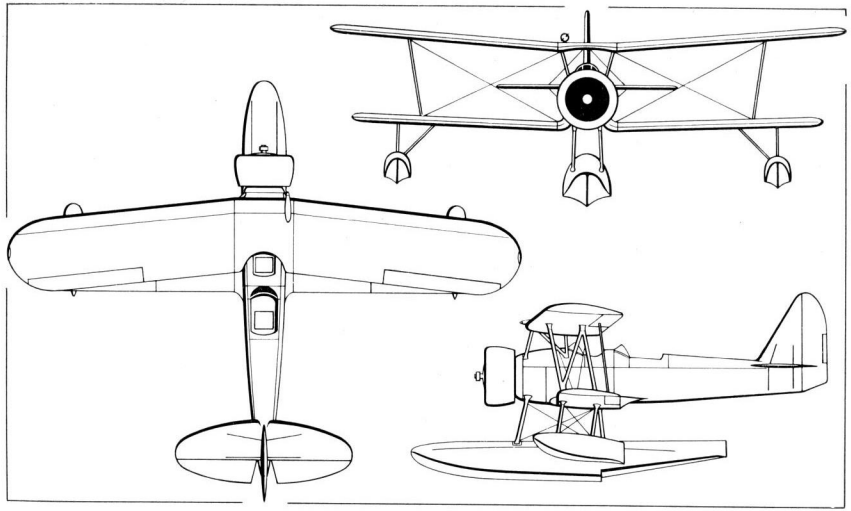
NAKAJIMA E8N1 AND E8N2 (DAVE) — JAPAN

Enjoying service longevity equalled only by the Kawanishi E7K1-2, Nakajima's E8N1 was the winner of an 8-*Shi* contest for a catapult-launched short-range reconnaissance floatplane, and was essentially a refinement of the E4N2 which, in turn, had been derived from the original Vought Corsair of the 'twenties. Designed in 1933, the E8N1 was selected by the J.N.A.F. in September 1935 after comparative trials with Aichi and Kawanishi designs, entering production as the Type 95 Reconnaissance Floatplane Model 11.

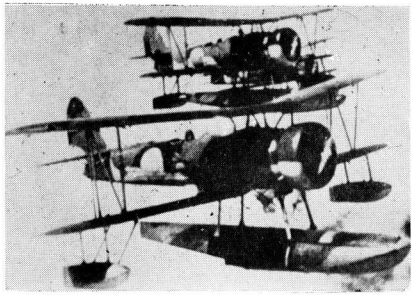
Powered by a 580 h.p. Nakajima Kotobuki 2 Kai I nine-cylinder radial air-cooled engine, the E8N1 was exceptionally manoeuvrable for a floatplane, and its rugged structure permitted its use on occasions as a dive bomber. Employed throughout the Sino-Japanese conflict during the opening stages of which the E8N1 gained some fame by destroying several Chinese fighters in aerial conflict, the floatplane became a standard cruiser-launched or off-shore-based reconnaissance type, and 751 examples had been produced when production finally terminated early in 1940, forty-eight of these being built by Kawanishi. The final production aircraft were of the E8N2 type powered by the Kotobuki 2 Kai II engine, and one of the last active missions of this type was as a spotter plane during the Battle of Midway. Subsequently, most aircraft of this type were relegated to the training role, and others were used for liaison and coastal patrol until the closing stages of the Pacific War.

The E8N2 was employed as a spotter plane during the Battle of Midway but was subsequently relegated to the training rôle.

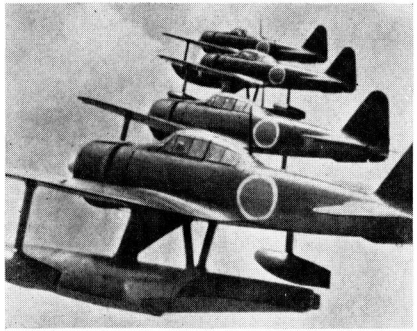




Type: *Two-seat Short-range Reconnaissance Float Seaplane.* **Power Plant:** *One* 580 *h.p. Nakajima Kotobuki* 2 *Kai I nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 7.7-*mm. machine gun and one flexible* 7.7-*mm. gun, plus two* 66-*lb. or* 132-*lb. bombs.* **Performance:** *Maximum speed,* 134 *m.p.h. at* 3,000 *ft.; cruising speed,* 138 *m.p.h. at* 8,200 *ft.* **Weights:** *Empty,* 3,020 *lb.; loaded,* 4,519 *lb.* **Dimensions:** *Span,* 33 *ft.* 0¾ *in.; length,* 28 *ft.* 10¾ *in.; height,* 13 *ft.* 0½ *in.; wing area,* 318.288 *sq. ft.*



NAKAJIMA A6M2-N (RUFE) JAPAN



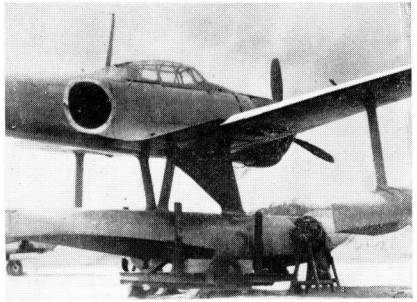
The development of a float fighter version of the Mitsubishi A6M2 Zero-Sen carrier fighter was assigned to the Nakajima Kikoki K.K. at the end of 1940, and work began on the project which was known as the AS-1 in February of the following year. The airframe was virtually identical to that of the Zero-Sen, apart from some redesign of the vertical tail surfaces to enlarge the rudder, and the provision of a small ventral fin. A large central float was attached to the fuselage by a forward-sloping pylon and braced aft by V-struts, and the two stabilising floats were each attached to the main spar by

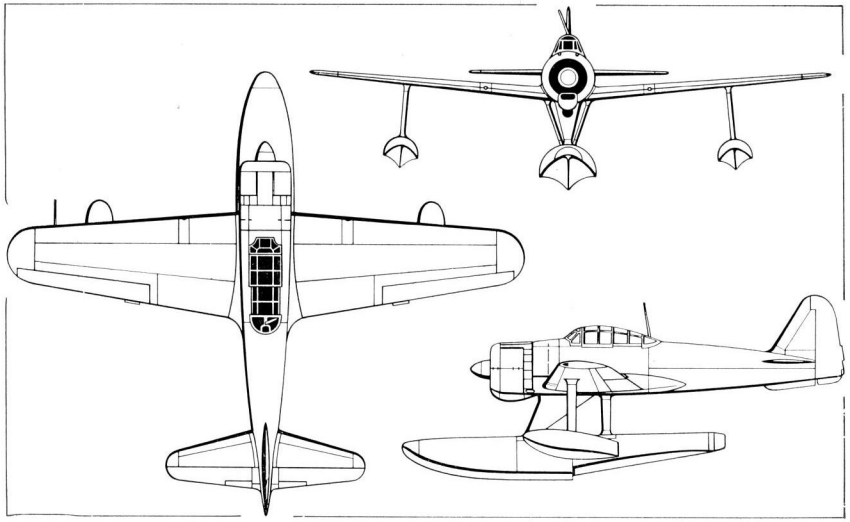
(Left and Below) The A6M2-N was intended to provide offensive air cover over Japanese landing operations but served primarily as a defensive fighter.

The airframe of the A6M2-N was virtually identical to that of the A6M2 Zero-Sen shipboard fighter, and it was first encountered at Guadalcanal. The A6M2-N was later assigned to the Fifth Fleet during the Aleutians campaign.

a slim, cantilever strut.

The prototype was completed in December 1941, and production began in April 1942 as the A6M2-N Type 2 Floatplane Fighter Model 11. Deliveries to the J.N.A.F. started before the end of the year, and the type was first encountered at Guadalcanal, later being assigned to the Fifth Fleet during the Aleutians campaign, being based on Kiska and Attu, serving as a defensive fighter and reconnaissance fighter rather than as an offensive air cover fighter for use over Japanese landing operations as originally envisaged. Despite its low performance, the A6M2-N was even based at Shimushu for the defence of Paramushiro in northern Japan and, later, on Lake Biwa for the defence of the home island of





Honshu.

Nakajima's Koizuma plant built a total of 327 A6M2-Ns before production terminated in September 1943, but during the closing stages of the Pacific War this type had been largely relegated to the training role owing to its low performance.

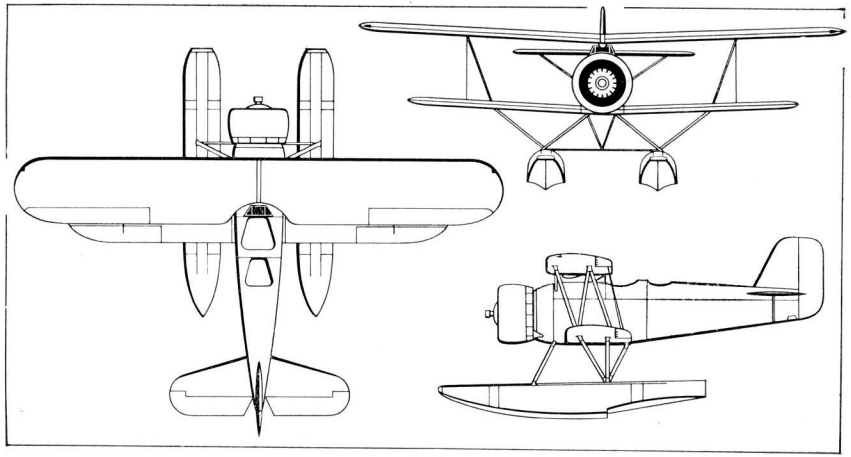
Type: *Single-seat Interceptor Fighter and Fighter-bomber Float Seaplane.* **Power Plant:** *One* 1,000 *h.p. Nakajima Sakae* 12 *fourteen-cylinder radial air-cooled engine.* **Armament:** *Two* 7.7-*mm. Type* 97 *machine guns with* 500 *r.p.g. and two* 20-*mm. Type* 99 *cannon with* 60 *r.p.g., plus two* 66-*lb. or* 132-*lb. bombs.* **Performance:** *Maximum speed,* 270 *m.p.h. at* 14,110 *ft.; cruising speed,* 184 *m.p.h at* 13,120 *ft.; time to* 9,840 *ft.,* 3 *min.* 57 *sec., to* 16,400 *ft.,* 6 *min.* 43 *sec.; service ceiling,* 32,000 *ft.; maximum range,* 1,108 *mls.* **Weights:** *Empty,* 4,235 *lb.; loaded,* 5,423 *lb.* **Dimensions:** *Span,* 39 *ft.* 4½ *in.; length,* 33 *ft.* 2¾ *in.; height,* 14 *ft.* 1¼ *in.; wing area,* 241.542 *sq. ft.*

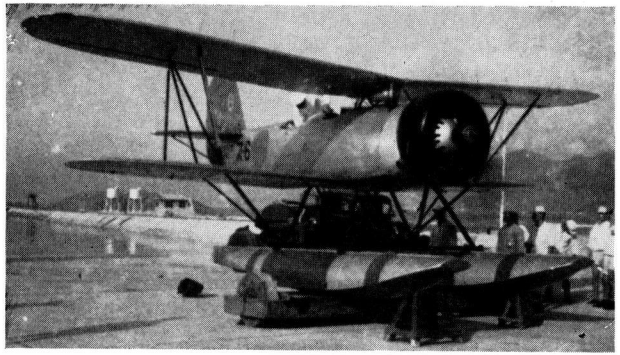
WATANABE E9W1 (SLIM)

JAPAN

The E9W1 was designed and built by the Watanabe Tekkosho to meet a 9-*Shi* requirement for a small reconnaissance seaplane capable of being transported in a watertight hangar aboard a submarine and subsequently assembled on deck prior to launching. A two-seater powered by a 300 h.p. Hitachi GK2 Tempu II nine-cylinder radial air-cooled engine, the E9W1 had folding wings and collapsible floats, and the first prototype was completed and flown in February 1935.

After successful evaluation trials aboard the submarine I-5, the E9W1 was accepted for production as the Type 96 Reconnaissance Seaplane Model 11. Two additional prototypes were followed by thirty-two production machines which were assigned to patrol submarines in 1938. In 1937 the Yokosuka-designed E14Y1 had been selected to replace the E9W1, but the Watanabe biplane was still in service at the beginning of the Pacific War, and fourteen were serving aboard various submarines of the Japanese Combined Fleet on July 14, 1942, although shortly after this date they had been supplanted by the E14Y1 which was also built by Watanabe (reorganised as the Kyushu Hikoki K.K. in 1943). The operational activities of the E9W1 were largely confined to the China Sea where it served to search out Chinese vessels endeavouring to run the Japanese blockade of the coastline and guide its parent submarine to the target.





The E9W1 was the first submarine-borne aircraft to enter service with the Japanese Navy, the type being assigned to patrol submarines in 1938.

Type: *Two-seat Submarine-borne Observation Twin-float Seaplane.* **Power Plant:** *One* 300 *h.p. Hitachi GK2 Tempu II nine-cylinder radial air-cooled engine.* **Armament:** *One* 7.7-*mm. machine gun on flexible mounting.* **Performance:** *Maximum speed,* 144 *m.p.h.; cruising speed,* 92 *m.p.h.; time to* 9,840 *ft.,* 9 *min.* 41 *sec.; service ceiling,* 22,100 *ft.; endurance,* 4.9 *hr.* **Weights:** *Empty,* 1,940 *lb.; loaded,* 2,756 *lb.* **Dimensions:** *Span,* 32 *ft.* 9½ *in.; length,* 26 *ft.* 3 *in.; height,* 12 *ft.* 2 *in.; wing area,* 252.95 *sq. ft.*

YOKOSUKA E14Y1 (GLEN) JAPAN

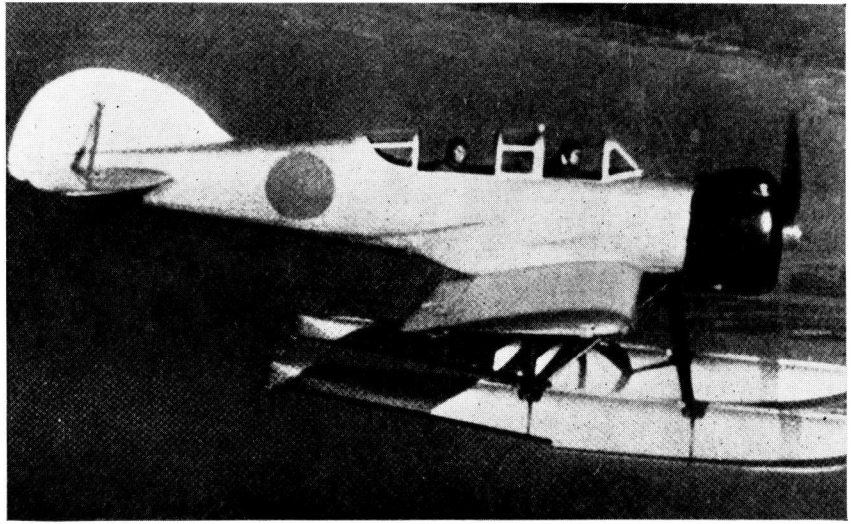
In 1937, the 1st Naval Air Technical Arsenal at Yokosuka (Dai-ichi Kaigun Gijitsusho) began the design of a small submarine-borne monoplane to a 12-*Shi* requirement which called for a replacement for the Watanabe E9W1. The Watanabe Tekkosho submitted its own design, the E14W1, to meet the requirement, but the design produced by Mitsuto Yamada of the Arsenal was eventually selected in modified orm, production being assigned to Watanabe as the E14Y1 Type O Small Aircraft Mark 1 Model 1 (later redesignated Type O Small Reconnaissance Seaplane Model 11).

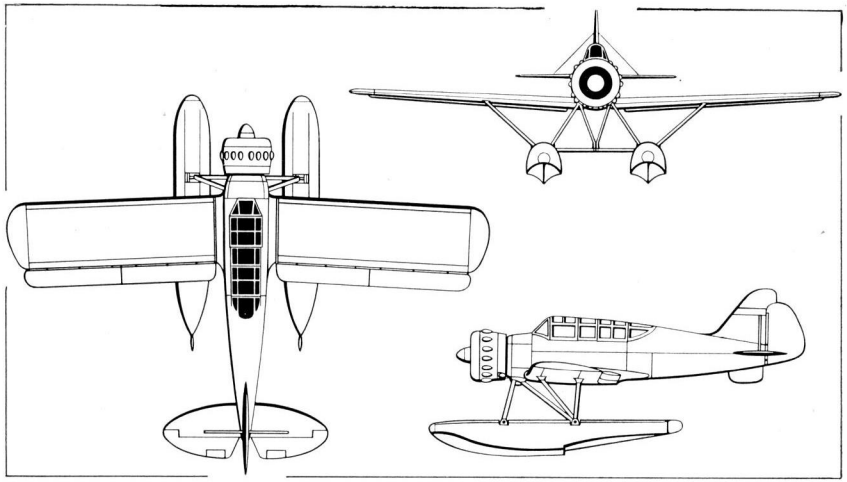
Destined to be built in larger numbers than any other submarine-borne aircraft, the E14Y1 was of mixed construction with a welded steel-tube fuselage covered forward with light metal panels, aft with fabric over light wooden formers and on the underside with metal sheet, and the wings had light metal spars, wooden ribs and fabric covering. The single-step floats were attached to the fuselage by transverse inverted W-struts and to the wings by sloping V-struts, and these could be detached from the fuselage and struts for stowage aboard the submarine. The wings could be detached from the fuselage at the spar fittings, the flaps and ailerons folding under the wings and the V-struts hingeing at the wing attachments to fold up against the lower surfaces. The top section of the fin and the ventral

stabilising surface below the rear fuselage were also detachable, and the outer sections of the tailplane folded upwards for stowage.

The E14Y1 was powered by a nine-cylinder Tempu 12 radial engine, and this was started up while the aircraft was still inside the submarine's cylindrical hangar. After removal from the hangar the wings, fins, and floats were attached, the tailplane unfolded, and the floatplane catapulted from the deck of the submarine. Production of the E14Y1 was begun in 1940, and the first deliveries to the J.N.A.F. began in the late summer of 1941, the first operational sortie of one of these floatplanes taking place ten days after the beginning of the Pacific War when an E14Y1 reconnoitred Pearl Harbour to obtain details of the results of the Japanese attack on the base. E14Y1s were carried by Model A (I-15 to I-35 inclusive) and Model B (I-9 to I-11 inclusive) submarines, but their operation presented a number of difficulties, demanding

The E14Y1 gained the distinction of being the only Japanese warplane to drop bombs on the U.S.A., this event taking place in 1942 *when two light bombs were dropped by an aircraft of this type during a reconnaissance flight from its parent submarine.*





highly skilled personnel, and the recovery of the aircraft proved hazardous. Nevertheless, the E14Y1 saw extensive use and made several reconnaissance sorties along the North American coastline. In fact, to this floatplane went the distinction of dropping bombs on the North American continent, this event taking place in September 1942 when an E14Y1 dropped two light bombs harmlessly in an Oregon forest.

The E14Y1 undertook reconnaissance missions over the Aleutians, Madagascar, and the Australian, African and New Zealand coastlines, and one example even visited Germany with the submarine I-8 in the summer of 1943. When production was completed in 1943, a total of 126 floatplanes of this type had been manufactured.

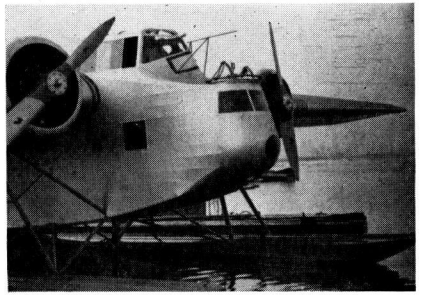
Type: *Two-seat Submarine-borne Twin-float Reconnaissance Seaplane.* **Power Plant:** *One* 340 *h.p. Tempu* 12 *nine-cylinder radial air-cooled engine.* **Armament:** *One* 7.7-*mm. machine gun and two* 110-*lb. bombs.* **Performance:** *Maximum speed,* 153 *m.p.h. at sea level; cruising speed,* 104 *m.p.h. at* 3,280 *ft.; time to* 9,840 *ft.,* 10 *min.* 11 *sec.; service ceiling,* 17,780 *ft.; range,* 548 *mls.; endurance,* 5.6 *hr.* **Weights:** *Empty,* 2,467 *lb.; loaded,* 3,197 *lb.; maximum,* 3,527 *lb.* **Dimensions:** *Span,* 32 *ft.* 9¾ *in.; length,* 28 *ft.* 0¼ *in.; height* 12 *ft.* 5¾ *in.; wing area,* 204.514 *sq. ft.*

FOKKER T.IVa

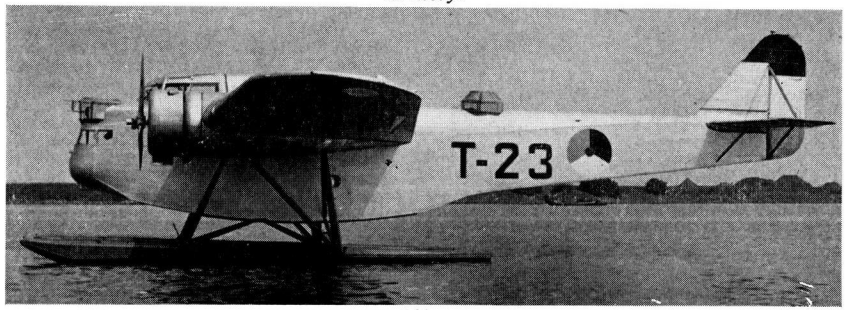
NETHERLANDS

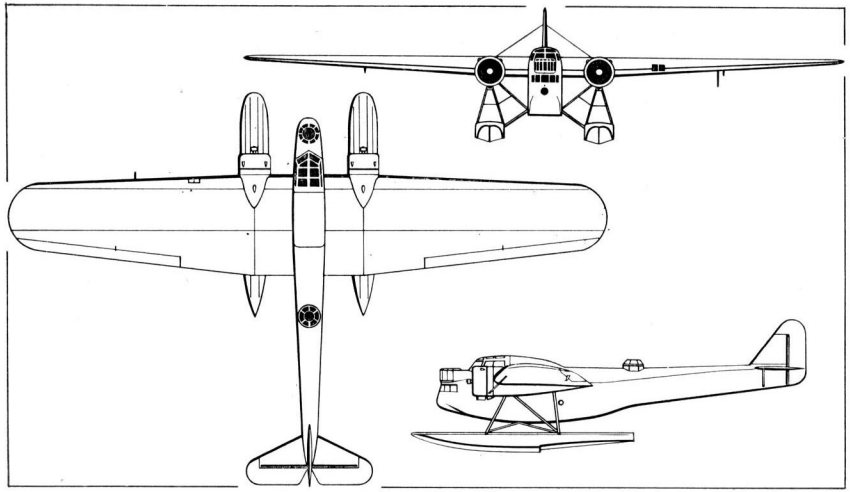
Aesthetically one of the most unattractive twin-engined float seaplanes to see operational service during the Second World War, the Fokker T.IVa stemmed from design work initiated in 1926 for a four-seat torpedo-bomber and reconnaissance floatplane to meet *Marine Luchtvaartdienst* requirements. Designated T.IV. and powered by two 450 h.p. Lorraine-Dietrich 'W' Type engines, the prototype was flown for the first time on June 7, 1927. Of mixed construction with a welded steel-tube rectangular-section fuselage and spruce and plywood wings, the T.IV was intended primarily for use in the Netherlands East Indies, and twelve aircraft were ordered, including the prototype.

Despite the obsolescence of the basic design, in 1935 a batch of twelve examples of a modernised version, the T.IVa, was ordered, this featuring a redesigned nose in which the open cockpit for pilot and co-pilot was fully enclosed, the contours of the fuselage nose were modified, windows being introduced for the forward observer, and 768 h.p. Wright Cyclone SR-1820-F2 air-cooled radials supplanted the liquid-cooled Lorraine-Dietrichs. Subsequently, the original T.IVs were brought up to T.IVa standards, and late production machines were equipped with enclosed bow and dorsal turrets.



The T.IVa was serving in the Netherlands East Indies at the time of the Japanese invasion of the territory.





The T.IVa was an exceptionally seaworthy machine and established a reputation for reliability. All aircraft of this type were serving in the Netherlands East Indies at the time of the Japanese invasion, subsequently being used for coastal patrol, long-range reconnaissance and anti-submarine duties.

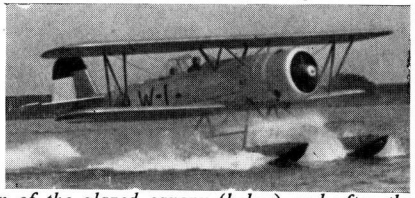
Type: *Four-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 768 *h.p. Wright Cyclone SR*-1820-*F*2 *nine-cylinder radial air-cooled engines.* **Armament:** *One* 7.9-*mm. FN Browning machine gun on flexible mount in each of bow, dorsal and ventral positions, plus four* 440-*lb. bombs, eighteen* 110-*lb. bombs or one torpedo.* **Performance:** *Maximum speed,* 161 *m.p.h. at* 2,624 *ft.; cruising speed,* 135 *m.p.h.; time to* 3,280 *ft.,* 3.1 *min., to* 6,560 *ft.,* 6.9 *min., to* 9,840 *ft.,* 11.7 *min.; service ceiling,* 19,360 *ft.; range,* 970 *mls. at* 135 *m.p.h. at* 2,634 *ft.* **Weights:** *Empty,* 10,284 *lb.; loaded,* 15,873 *lb.* **Dimensions:** *Span,* 85 *ft.* 11½ *in.; length,* 57 *ft.* 8⅞ *in.; height,* 19 *ft.* 8¼ *in.; wing area,* 1,052.7 *sq. ft.*

FOKKER C.XI-W

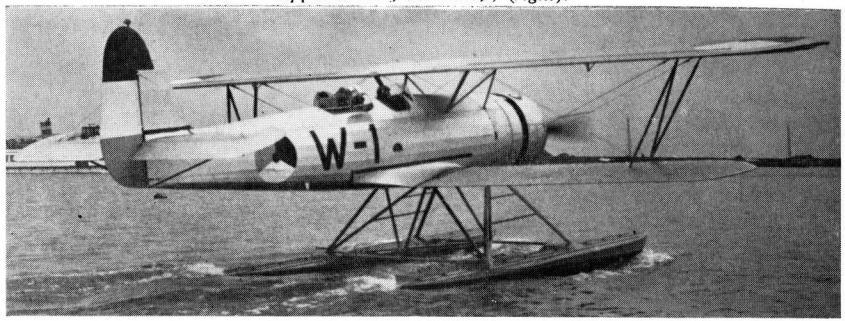
NETHERLANDS

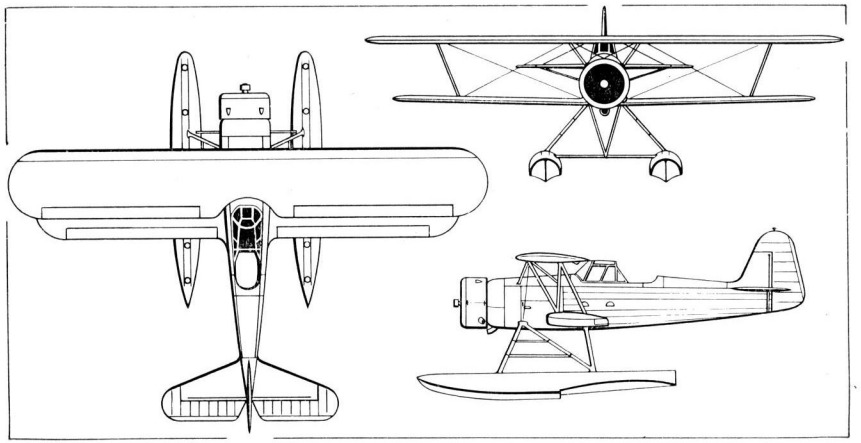
Intended for naval operation from shore bases or from ships of the Netherlands Navy, the C.XI-W was designed in 1934 as a two-seat reconnaissance floatplane and, despite the fact that only one Dutch naval vessel, the cruiser *De Ruyter*, was fitted with a catapult, it was stressed for catapult launching. The C.XI-W employed a typical Fokker structure, the wings having two wooden spars with plywood ribs and fabric covering, and the fuselage being of fabric-covered welded steel-tube. The single-step floats were of duralumin and Alclad, these being mounted on a steel-tube chassis welded to the fuselage, and alternative power plants were the Wright Cyclone SR-1820-F-52 and the Bristol Pegasus III, both rated at 775 h.p.

The prototype, initially registered PH-ALC, was flown for the first time on July 20, 1935, with the Wright Cyclone engine, and was later flown to Bremerhaven for catapult trials. After some modifications, including some redesign of the floats, rearrangement of the chassis bracing and the partial enclosure of the tandem cockpits by a sliding canopy, the C.XI-W was accepted by the *Marine Luchtvaartdienst* (M.L.D.), and thirteen additional machines were ordered, these entering service in 1938, the majority of them being despatched to the Netherlands East Indies. The last production C.XI-W (W-14) was still in the Netherlands at the time of the German invasion and was flown to the United Kingdom on May 22, 1940, subsequently being crated and

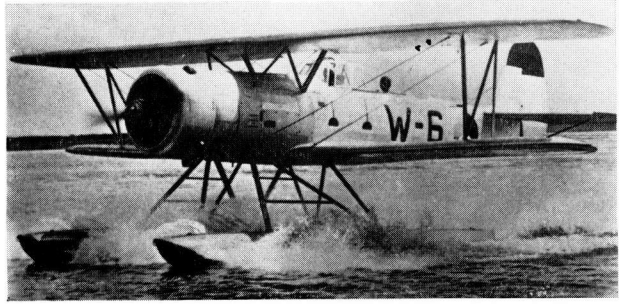


The prototype C.IX-W prior to the introduction of the glazed canopy (below) and after the application of the canopy (right).





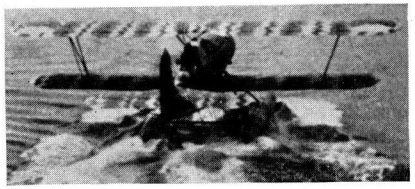
The C.XI-W was used extensively for reconnaissance in the East Indies.



sent to the East Indies. After the Dutch declaration of war on Japan, eight C.XI-Ws were operational in the East Indies. They were used extensively for reconnaissance but none survived the Japanese invasion of Java.

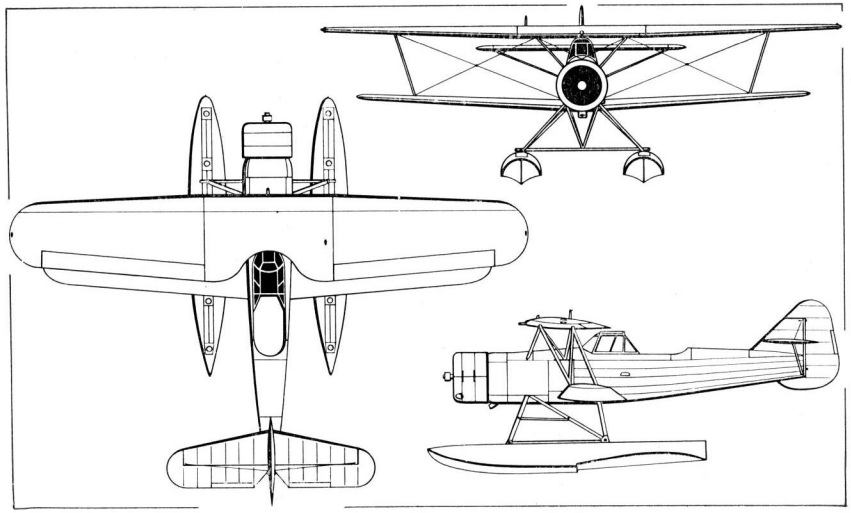
Type: *Two-seat Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 775 *h.p. Wright Cyclone SR*-1820-*F*-52 *nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-*

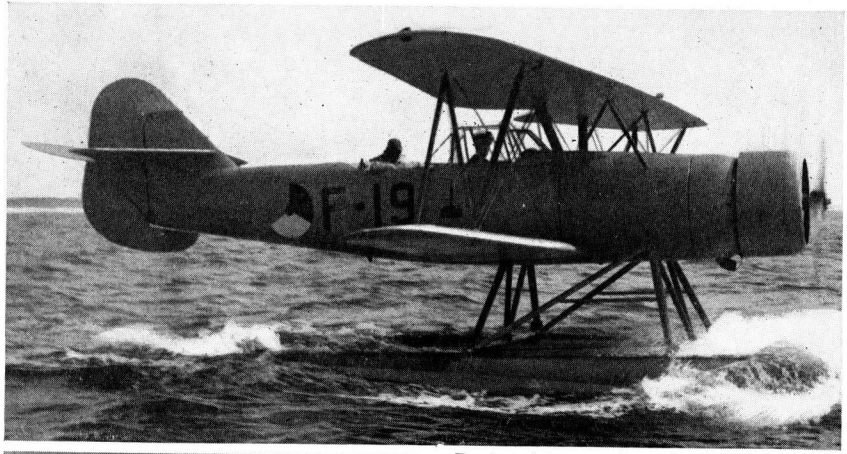
firing 7.9-*mm. FN-Browning machine gun and one* 7.9-*mm. gun on moveable mount in observer's cockpit.* **Performance:** *Maximum speed,* 174 *m.p.h. at* 5,750 *ft.; cruising speed,* 146 *m.p.h. at* 5,750 *ft.; time to* 3,280 *ft.,* 2.4 *min., to* 9,840 *ft.,* 7.9 *min., to* 16,400 *ft.,* 17.5 *min.; service ceiling,* 20,990 *ft.; absolute ceiling,* 22,300 *ft.; range,* 453 *mls.* **Weights:** *Empty,* 3,792 *lb.; loaded,* 5,622 *lb.* **Dimensions:** *Span,* 42 *ft.* 8 *in.; length,* 34 *ft.* 1 *in.; height,* 14 *ft.* 9 *in.; wing area,* 430.4 *sq. ft.*

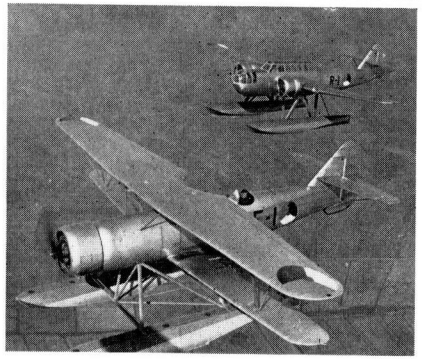


A camouflaged C.XI-W float seaplane.

FOKKER C.XIV-W — NETHERLANDS







Designed to supplant the C.VII-W in the dual advanced training and light reconnaissance role with the *Marine Luchtvaartdienst* (M.L.D.), the C.XIV-W was flown for the first time in 1939, and bore a close resemblance to the more powerful C.XI-W. The principal external difference between the two types was in the planform of the unequal-span wings, those of the C.XI-W possessing no taper and those of the C.XIV-W having taper on both leading and trailing edges. The fuselage was of welded chromemolybdenum steel tube with dural and fabric covering, and the staggered wings were wooden structures with two box spars, bakelite-plywood ribs and plywood and fabric covering.

The prototype was initially flown with open cockpits, but sliding canopies were later fitted and these were standardised for the twenty-

three additional C.XIV-Ws built, all of which had been delivered at the time of the German invasion and were being introduced into service with the M.L.D. at that time. A few of the C.XIV-W floatplanes were used for coastal patrol and reconnaissance during the first days of the German onslaught, but on May 12, 1940, they were ordered to fly to France, together with other M.L.D. aircraft. Eleven were subsequently flown to the United Kingdom where they were crated and eventually shipped to the Netherlands East Indies. In the East Indies the floatplanes were used in the training role for which they had been primarily intended, but all were destroyed during the Japanese invasion. Although the C.XIV-W normally carried no armament, two 7.9-mm. machine guns could be fitted, one firing forward from the fuselage nose with 250 rounds, and one on a flexible mount in the observer's cockpit with 500 rounds.

Type: *Two-seat Advanced Training Twin-float Seaplane.* **Power Plant:** *One* 450 *h.p. Wright R-975E-3 Whirlwind nine-cylinder radial air-cooled engine.* **Performance:** *Maximum speed,* 143 *m.p.h. at* 1,400 *ft.; cruising speed (two-thirds power),* 120 *m.p.h., (*55 *per cent. power),* 110 *m.p.h.; time to* 3,280 *ft.,* 3.8 *min., to* 6,560 *ft.,* 8.5 *min., to* 9,840 *ft.,* 14.9 *min.; service ceiling,* 15,750 *ft.; absolute ceiling,* 17,715 *ft.; range,* 590 *mls. at* 110 *m.p.h. at* 1,400 *ft.* **Weights:** *Empty,* 2,930 *lb.; loaded,* 4,300 *lb.* **Dimensions:** *Span,* 39 *ft.* 5 *in.; length,* 31 *ft.* 2 *in.; height,* 13 *ft.* 11 *in.; wing area,* 340 *sq. ft.*

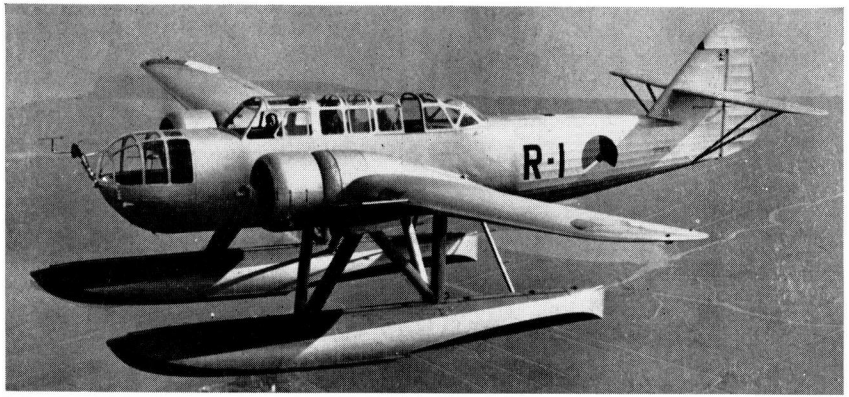
FOKKER T.VIII-W

NETHERLANDS

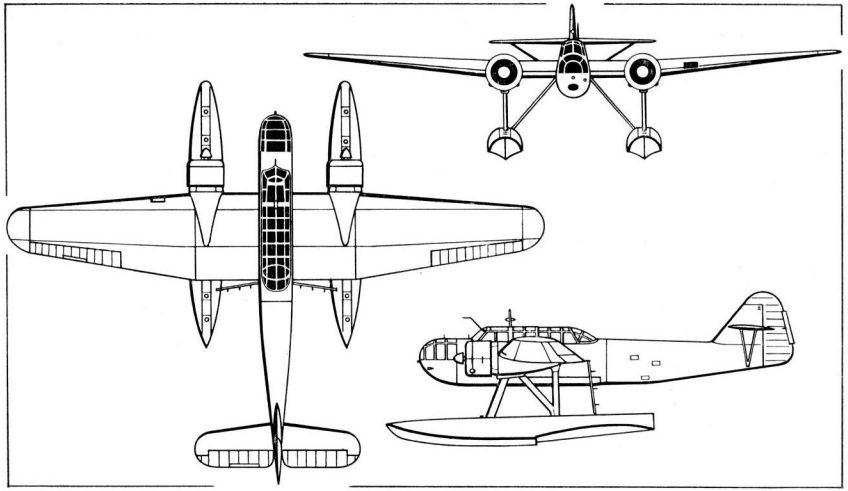
The T.VIII-W was designed in 1937 to meet *Marine Luchtvaartdienst* (M.L.D.) requirements for a successor for the obsolescent T.IV floatplane in the torpedo-bomber and reconnaissance roles, and the first of an initial batch of five machines designated T.VIII-W/G (the "G" suffix letter indicating *Gemengd* or mixed construction) was flown in 1938, a further fourteen T.VIII-W/G floatplanes being subsequently ordered.

The T.VIII-W/G had a wooden wing comprising two box spars with spruce flanges and plywood webs, plywood ribs and bakelite-plywood skinning. The fuselage was built in three sections, the forward section being a light alloy monocoque, the centre section being a wooden monocoque and the aft section being a fabric-covered welded steel-tube structure. The single-step all-metal floats were attached to the engine nacelles by vertical N-struts and braced to the fuselage by parallel sloping struts, and power was provided by two Wright Whirlwind R-975-E-3 nine-cylinder radials each rated at 450 h.p. for take-off and 420 h.p. at 1,400 ft. An alternative power plant was the 350 h.p. Armstrong Siddeley Cheetah X, although this engine was never installed.

Deliveries of the T.VIII-W/G to the M.L.D. began in 1939, and one of the first production aircraft was forced down on September 13 of that year by a Dornier Do 18 of the Luftwaffe, the crew of the German flying boat having mistaken the Dutch insignia for French or British roundels. By May 10, 1940, when German forces invaded the Netherlands, eleven T.VIII-W/G floatplanes had been delivered to the M.L.D., and an order had been placed for twelve examples of a modified version, the T.VIII-W/M, the "M" suffix indicating *Metaal* and referring to the light metal monocoque rear fuselage section which supplanted the earlier fabric-covered



(*Above*) *The first prototype T.VIII-W/G floatplane, and* (*below*) *one of the T.VIII-W/G aircraft operated by No.* 320 *Squadron from Pembroke Dock with R.A.F. Coastal Command.*

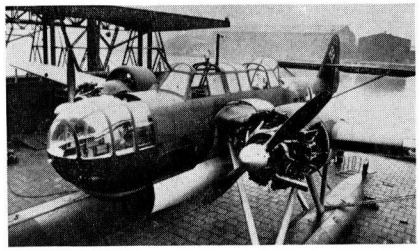


steel-tube rear fuselage.

The T.VIII-W/G floatplanes were engaged in patrolling the Dutch coastline during the early stages of the attack, one flying two members of the Dutch cabinet to the United Kingdom, but on May 12, these floatplanes, together with other M.L.D. aircraft, were ordered to France, the T.VIII-W/G floatplanes flying to Cherbourg and Brest from which bases it was planned that they should continue operations. However, with the rapid advance of the Wehrmacht, it was decided to transfer the M.L.D. aircraft to the United Kingdom on May 22, and the T.VIII-W/G floatplanes formed the equipment of No. 320 Squadron which operated from Pembroke Dock with R.A.F. Coastal Command, undertaking convoy patrols over the Western Approaches. The eight aircraft of this type which reached the United Kingdom were allocated the serial numbers AV958-965, and two had been lost on operations before, in September 1940, spares were no longer available to keep the Fokker floatplanes serviceable, and No. 320 Squadron began conversion to the Lockheed Hudson.

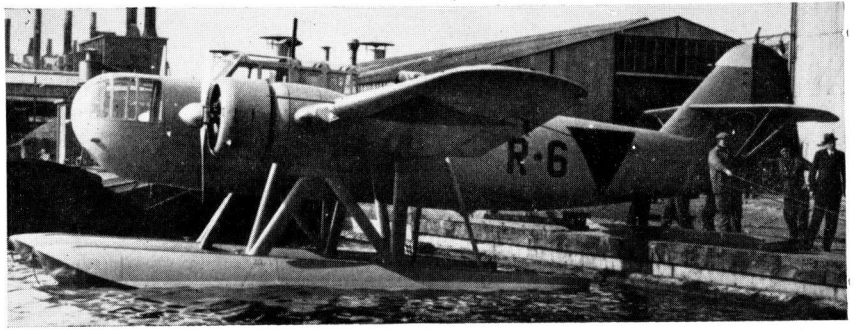
With the occupation of the Netherlands, the remaining eight T.VIII-W/G floatplanes on Fokker's assembly line together with the twelve partly-built T.VIII-W/M floatplanes

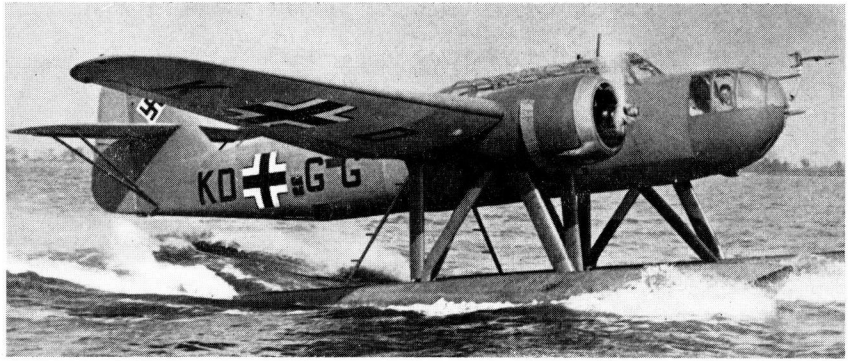
were completed and delivered to the Luftwaffe, being operated by this service in the reconnaissance, anti-shipping and air-sea rescue roles in the North Sea and the Mediterranean. In addition to these aircraft, the Luftwaffe received five examples of a larger, more powerful variant of the basic design which had been under construction for the Finnish government.



The Finnish government had evinced an interest in the T.VIII-W early in 1939 as a potential replacement for the obsolete Blackburn Ripon. The Finns stipulated substantial increases in performance and useful load and an interchangeable wheel/float/ski undercarriage. Such an undercarriage had been envisaged and designed at an early stage in the development of the aircraft, and primarily to meet Finnish requirements and potential Swedish interest, a more powerful, scaled-up version of the T.VIII-W was designed, wing span and area being increased by 6 ft. 6⅔ in. and 86.1 sq. ft. respectively, and overall length being increased by 6 ft. Three alternative engines were proposed, the Bristol Mercury VI (T.VIII-W/A), the Bristol Pegasus XXIV (T.VII-W/B) and the Bristol Mercury XI (T.VIII-W/C). The last-mentioned power plant was selected, and five T.VIII-W/C aircraft were under construction for Finland at the time of the German invasion of the Netherlands. One of these aircraft was fitted

(*Above*) *One of the T.VIII-W/M floatplanes delivered to the Luftwaffe and* (*below*) *the sixth T.VIII-W/G.*





(*Above*) *One of the four T.VIII-W/C floatplanes completed. These were more powerful and had larger overall dimensions than their predecessors.*

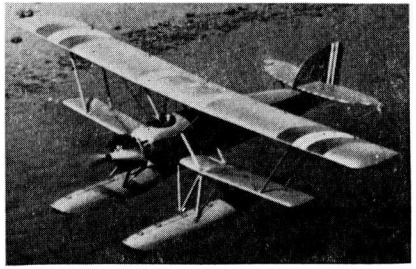
with a fixed wheel-undercarriage as the T.VIII-L. After the completion of these aircraft no further T.VIII-Ws were built, the Fokker plant subsequently concentrating on the manufacture of floats for the Ju 52/3mW, Bücker Bü 181 trainers and Arado Ar 196A-5 floatplanes.

The following specification relates to the T.VIII-W/G, data in parentheses relating to the T.VIII-W/C.

Type: *Three-seat Torpedo-bomber and Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 450 (890) *h.p. Wright Whirlwind R-975-E-3* (*Bristol Mercury XI*) *nine-cylinder radial air-cooled engines.* **Performance:** *Maximum speed,* 177 (222) *m.p.h.; cruising speed,* 137 (166) *m.p.h.; range* (*with* 264 *Imp. gal.*), 1,305 (1,056) *mls.* (*with* 352 *Imp. gal.*), 1,710 *mls.; service ceiling,* 22,300 (19,030) *ft.* **Armament:** *Three* 7.9-*mm. FN-Browning machine guns and one torpedo or a* 1,300-*lb. bomb load.* **Weights:** *Empty,* 6,834 (9,998) *lb.; loaded,* 11,030 (15,432) *lb.* **Dimensions:** *Span,* 59 *ft.* 0⅔ *in.* (65 *ft.* 7⅓ *in.*)*; length,* 42 *ft.* 7¾ *in.* (48 *ft.* 7¾ *in.*)*; height,* 16 *ft.* 4¾ *in.* (17 *ft.* 8½ *in.*)*; wing area,* 473.612 (559.723) *sq. ft.*

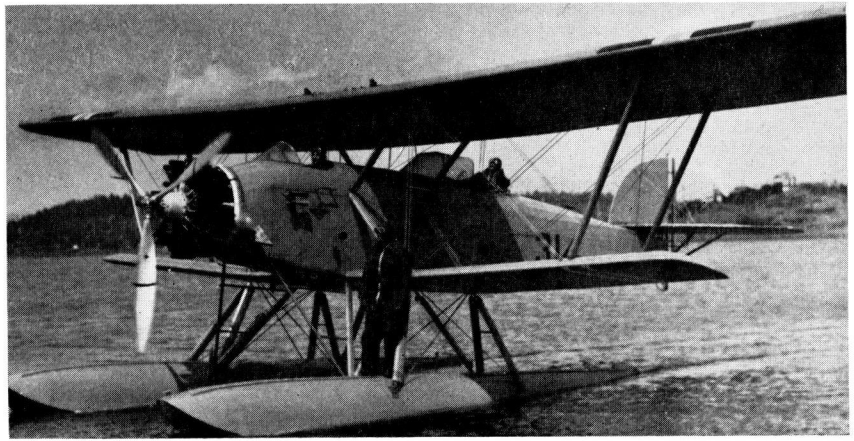
The sole T.VIII-L with fixed wheel undercarriage.

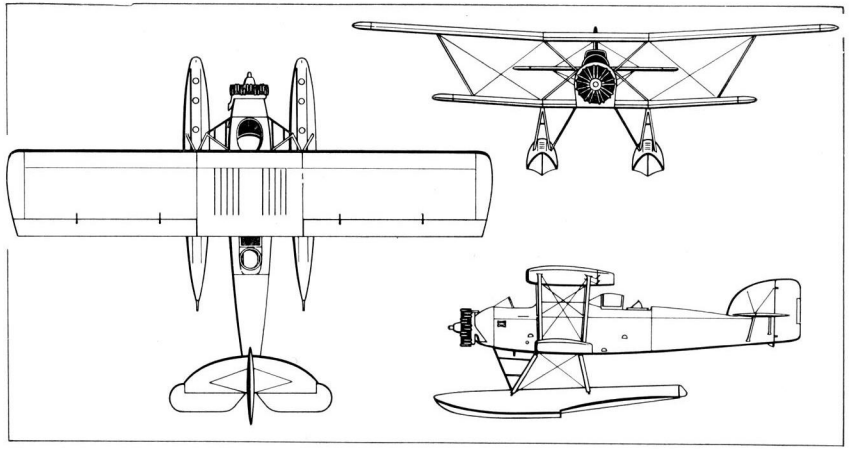
HØVER M.F.11 NORWAY



During the late 'twenties it was becoming increasingly obvious to the Norwegian Navy that its Hansa Brandenburg W 33 reconnaissance floatplanes would soon need replacement, and the Marinens Flyvebatfabrikk, or Navy Aircraft Factory, at Horten therefore began the design of a suitable replacement under the direction of Commander J. E. Høver. Designated M.F.11 and powered by an Armstrong Siddeley Panther radial air-cooled engine, the prototype was completed on September 29, 1931, and after successful evaluation trials, was placed in production at Horten. The M.F.11 was a three-seat, single-bay, unequal-span biplane of welded steel-tube

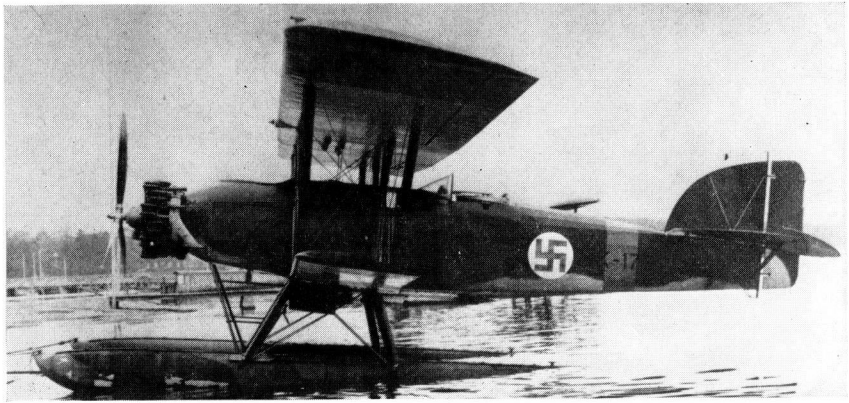
(*Above and below*) *The M.F.*11 *saw considerable operational service during the German invasion.*





construction with fabric covering, and the first three aircraft were delivered to the Norwegian Navy during 1933. In the meantime, the licence manufacture of the Panther II engine had been undertaken, and the first M.F.11 to be equipped with a Norwegian-built power plant produced by the Marinens Minevesen was flown in the summer of 1935.

Between 1936 and 1939, the M.F.11 floatplanes participated in all manoeuvres undertaken by the Norwegian armed forces, and when German forces invaded Norway, twenty-five M.F.11s had been delivered and four additional machines were under construction. By this time, the M.F.11 had established an enviable reputation for reliability, and some of the aircraft serving with the Norwegian Navy had logged as many as nine hundred hours in the air. At the time of the German invasion, four M.F.11s were based at the Flatøen Naval Air Station, near Bergen, five were based at Horten, three were based at Kristiansand, and one was based at Hitra, and from the outset these aircraft were active against the invading forces. On the first day of the fighting, the M.F.11s from Flatøen were loaded with 110-lb. bombs and attempted to bomb German warships off the Norwegian coast, but were thwarted by lack of bombsights and bad visibility. Three of the Horten-based M.F.11s were captured by German forces, and several other M.F.11s were lost in action, the survivors flying to Hardangerfjord and Sognefjord from where they continued operations until the evacuation of Southern Norway. Two flew to the Skattøra Naval Air Base, Tromsø,



where they joined two other M.F.11s, the Hitra-based aircraft was forced down by British fighters when flying towards the Hebrides, and two flew to the Shetlands, but one of these was shot down by British anti-aircraft fire before it could reach its destination. Another M.F.11 had flown to Scotland earlier, and together with the machine that had reached the Shetlands, flew back to Tromsø to participate in the final stages of the Norwegian battle.

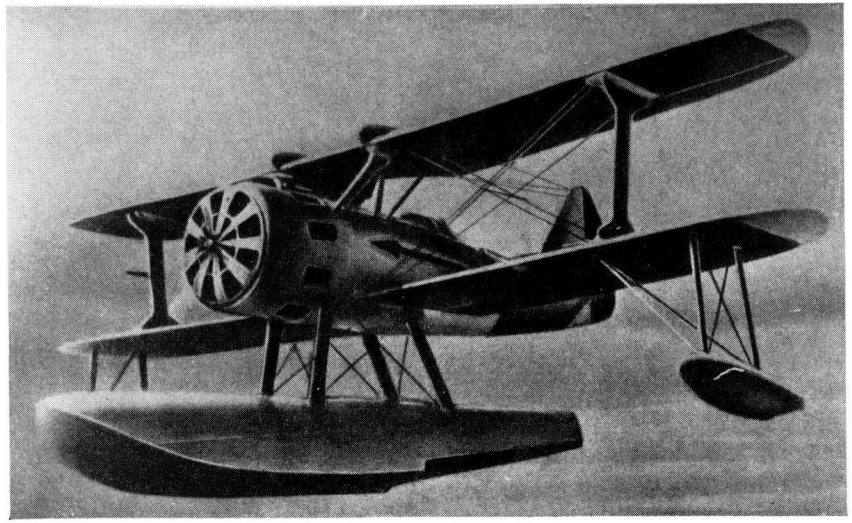
With the withdrawal of the Allied forces from Norway, three of the surviving M.F.11s were flown to Rovaniemi where they were interned by the Finns, and three others were left at the Skattøra Naval Air Base where they were captured by German forces. The four M.F.11s that had been nearing completion at Horten at the time of the invasion had been dismantled and hidden, but they were eventually discovered by the Germans, reassembled and, together with several other captured aircraft of this type, were employed for coastal patrol. The three that were interned in Finland also saw subsequent use, being taken over by the Finnish Air Force and used for coastal patrol and anti-submarine duties.

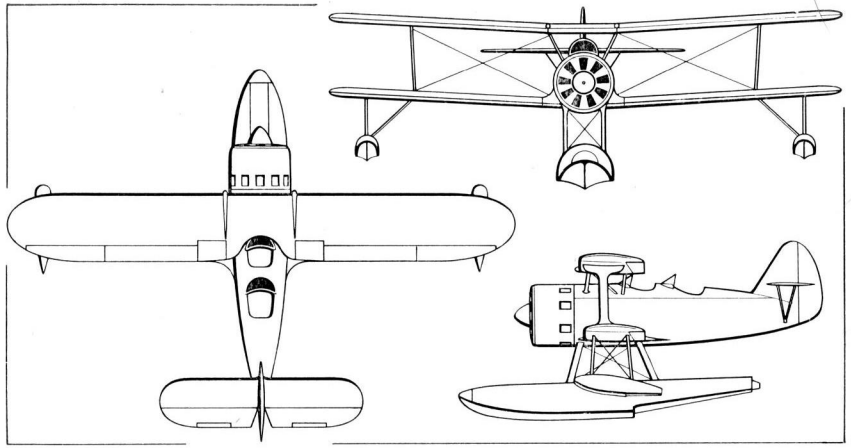
Type: *Three-seat Reconnaissance Twin-float Seaplane.* **Power Plant:** *One* 575 *h.p. Armstrong Siddeley Panther II fourteen-cylinder radial air-cooled engine.* **Armament:** *Two fixed forward-firing* 0.3-*in. Colt-Browning machine guns and one similar weapon on a flexible mount, plus three* 220-*lb. or four* 110-*lb. bombs.* **Performance:** *Maximum speed,* 133 *m.p.h. at sea level,* 146 *m.p.h. at* 2,790 *ft.; cruising speed,* 106 *m.p.h.; time to* 3,280 *ft.,* 3 *min.* 5 *sec., to* 6,560 *ft.,* 7 *min.* 7 *sec., to* 9,840 *ft.,* 14 *min.* 3 *sec.; service ceiling,* 16,400 *ft.; maximum endurance,* 7 *hr.* **Weights:** *Empty,* 4,078 *lb.; loaded,* 6,283 *lb.* **Dimensions:** *Span,* 50 *ft.* 6¼ *in.; length,* 38 *ft.* 1½ *in.; height,* 14 *ft.* 7⅛ *in.; wing area,* 575.868 *sq. ft.*

BERIEV KOR-1 AND KOR-2 — SOVIET UNION

Although the Soviet Navy employed substantial numbers of flying boats throughout the Second World War, singularly few float seaplanes were used. Apart from a very small number of float-equipped versions of standard landplanes, the only floatplanes to serve with the Soviet Navy during the years 1941-45 were the KOR-1 and KOR-2 designed by G. M. Beriev. Externally similar, these floatplanes were intended for use both from the catapults of Russian cruisers and from coastal bases, and were built in limited numbers.

The KOR-1 was flown in prototype form in 1934, having been built to the requirements of a specification calling for a shipboard two-seat observation-scout aircraft. Powered by a 750 h.p. M-25 nine-cylinder radial air-cooled engine derived from the Wright Cyclone, the KOR-1 was of all-metal construction with fabric covering. A single-step central float was braced to the forward fuselage by two parallel pairs of inclined struts, and each stabilising





float was braced to the lower wing by a pair of vertical struts and a pair of sloping struts. Armament comprised one fixed forward-firing 7.62-mm. machine gun and a similar weapon on a flexible mount for the observer. Light bombs could be carried on racks under the lower wing roots. Production of the KOR-1 was undertaken during 1935-36, the type being standard catapult equipment aboard cruisers of the Russian Navy during the immediate pre-war years.

In 1939, a more powerful development of the basic design intended to supplant the KOR-1 and designated KOR-2 was produced by Beriev, this having a 900 h.p. M-62 engine and slightly greater overall dimensions. Limited production of the KOR-2 was undertaken for the Soviet Navy in 1940, and apart from minor details both types were externally similar.

The following specification relates to the KOR-1, details in parenthesis relating to the KOR-2.

Type: *Two-seat Shipboard Observation-scout Float Seaplane.* **Power Plant:** *One* 750 (900) *h.p. M*-25 (*M*-62) *nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing and one flexible* 7.62-*mm. ShKAS machine gun plus two* 110-*lb. or four* 55-*lb. bombs.* **Performance:** *Maximum speed,* 149 (193) *m.p.h. at* 6,560 (4,920) *ft.; ceiling,* 22,966 *ft.; range,* 310 (404) *mls.* **Weights:** *No details available.* **Dimensions:** *Span,* 36 *ft.* 1 *in.* (37 *ft.* 0⅞ *in.*); *length,* 27 *ft.* 1¾ *in.* (29 *ft.* 5⅓ *in.*); *height,* 12 *ft.* 6 *in.*

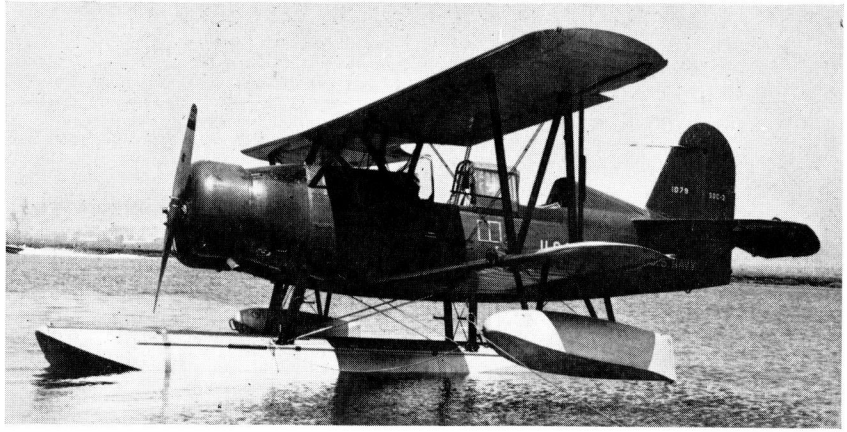
CURTISS SOC-1 - SOC-4 SEAGULL U.S.A.

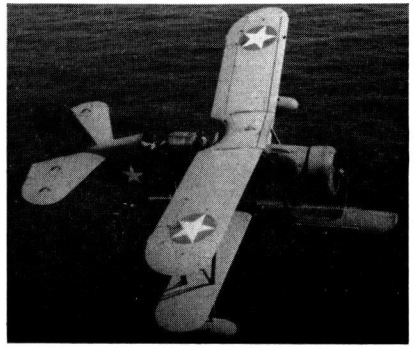
Intended to replace the Vought 03U Corsair series as a standard scout-observation biplane aboard aircraft carriers, battleships and cruisers of the U.S. Navy, the Seagull was ordered in prototype form as the XO3C-1 on June 19, 1933, competing with the Douglas XO2D-1 and Vought XO5U-1, all three aircraft featuring folding wings and amphibious landing gear, wheels retracting into a central float. The XO3C-1 flew for the first time in April 1934, but the amphibious gear was later abandoned, and in June 1935, the designation of the prototype was changed to XSOC-1.

Powered by a Pratt and Whitney R-1340-12 Wasp nine-cylinder radial engine rated at 600 h.p. for take-off and 550 h.p. at 5,000 ft., the XSOC-1 featured a single central float which was interchangeable with a single-strut cantilever land chassis. The fuselage was a fabric-covered welded chrome-molybdenum steel-tube structure, and the single-bay staggered wings were metal two-spar structures with fabric covering. The central float, which was attached to the fuselage by tandem pairs of parallel struts, housed an auxiliary fuel tank.

The XSOC-1 was successful in comparative trials with the Douglas and Vought contenders, and one hundred and thirty-five SOC-1 Seagulls were ordered for the U.S. Navy, these having the R-1340-18 engine and being

An all-blue fuselage distinguished this SOC-3 of the U.S. Navy Commander-in-Chief.



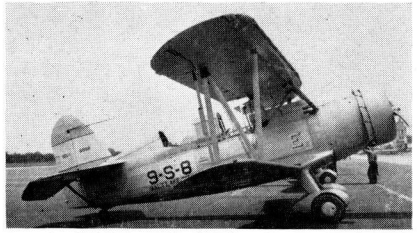


(*Above*) *An SOC-3 being catapulted from a cruiser during the attack on Wake Island of October* 5–6, 1943.

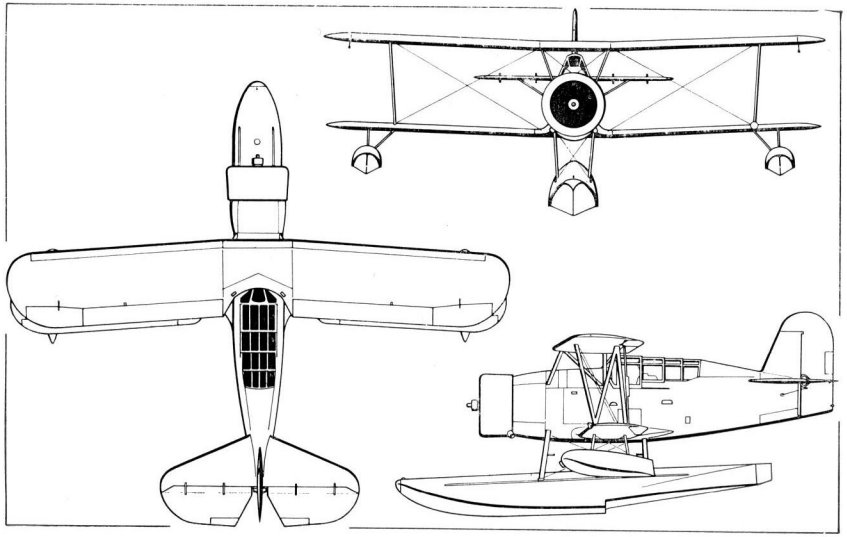
externally similar to the prototype apart from having a continuous canopy over the tandem cockpits. Both float and wheel undercarriages were ordered with each aircraft. The first production SOC-1s were delivered to the U.S.S. *Marblehead* on November 12, 1935, others reaching the Pensacola Naval Air Station during the same month, and by June 1936, the SOC-1 equipped VS-5B, -6B, -9S, -10S, -11S and -12S, the U.S.S. *Memphis's* Special Service Squadron, and the scouting forces of the U.S.S. *Indianapolis*, *Augusta* and *Raleigh*. Forty SOC-2s and -2As followed, these differing externally from the initial model in having no cowling gills for their R-1340-22 engines, and were delivered with wheel under

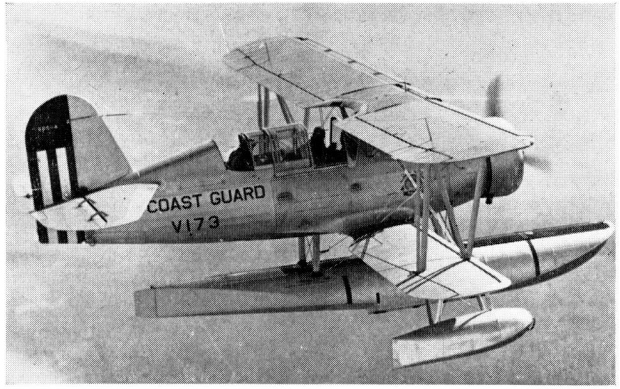
carriages only, the -2A being equipped with arrester gear for carrier operations.

The SOC-3, eighty-three examples of which were built, was similar to the -2 apart from a 100-lb. increase in all-up weight and in having the interchangeable landing gear, and three additional aircraft were completed as SOC-3A Seagulls with arrester hook. Forty-four SOC-3s and -3As were manufactured by the government-owned Naval Aircraft Factory at Philadelphia under the designations SON-1 and -1A, and the final variant of the Seagull was the SOC-4, three examples of which were



An SOC-1 with wheel undercarriage.





The U.S. Coast Guard received three SOC-4 Seagulls for rescue and patrol duties, one of these being illustrated above.

built for use by the U.S. Coast Guard, these being operated by this service until 1941. An experimental development of the SOC-3 with flaps on both wings (the SOC-3 having flaps on the upper wing only), a 5 ft. 1 in. increase in overall fuselage length and an R-1340-36 engine was the XSO2C-1.

Production of the Seagull terminated in May 1938, and in 1939 all observation and cruiser scouting squadrons were SOC-equipped. During its long operational career, the SOC was flown most extensively from the catapults of battleships and cruisers, although their aircraft often exchanged their floats for wheels for operation from shore stations. Most battleships carried four SOCs, and the Seagull outlived the SO3C which was its intended replacement, some seventy SOC biplanes still being in service with the U.S. Navy at the end of 1944. The Seagull saw action in the Atlantic, the Mediterranean and the Pacific, and among the most notable campaigns in which it participated were Guadalcanal, Wake Island, and the Marshall and Gilbert Islands.

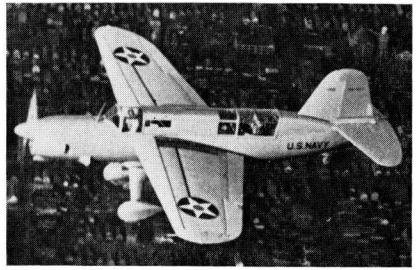
The following specification relates specifically to the SOC-1 but is generally representative of all versions of the Seagull. Figures in parentheses relate to the SOC-1 in its landplane configuration.

Type: *Two-seat Scout-observation Float Seaplane.* **Power Plant:** *One* 600 *h.p. Pratt and Whitney R*-1340-18 *Wasp nine-cylinder radial air-cooled engine.* **Armament:** *One* 0.3-*in. fixed forward-firing Colt-Browning machine gun with* 500 *rounds and one flexible* 0.3-*in. gun with* 600 *rounds, plus two* 100-*lb. bombs.* **Performance:** *Maximum speed,* 165 (168) *m.p.h. at* 5,000 *ft.; cruising speed,* 133 (137) *m.p.h.; service ceiling,* 14,900 (16,700) *ft.; range,* 675 (697) *mls. at* 5,000 *ft.* **Weights:** *Empty,* 3,788 (3,543) *lb.; loaded,* 5,437 (5,192) *lb.* **Dimensions:** *Span,* 36 *ft.* 0 *in.; length,* 31 *ft.* 5 *in.* (26 *ft.* 6 *in.); height,* 14 *ft.* 9 *in.* (13 *ft.* 0 *in.); wing area,* 342 *sq. ft.*

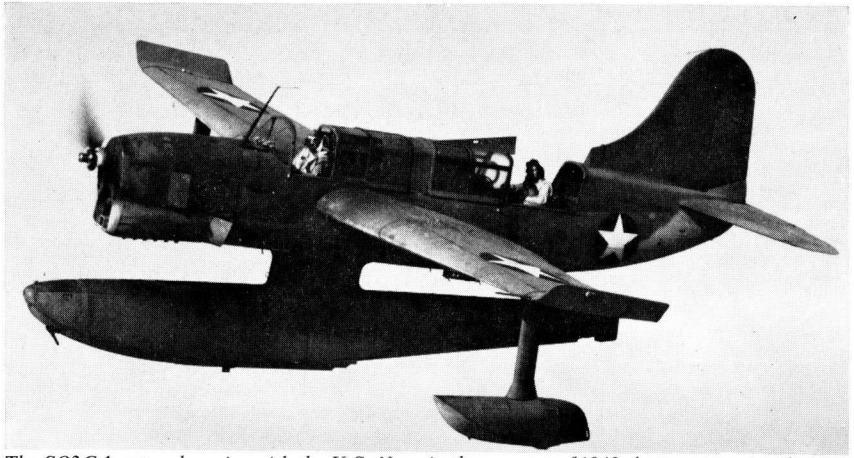
CURTISS SO3C-1 - SO3C-4 (SEAMEW) U.S.A.

Designed by Don R. Berlin as a "High Speed Scout" successor to the Curtiss SOC series, and originally dubbed Seagull like its predecessor, the SO3C-1 followed the U.S. Navy's traditional formula of medium-powered scout-observation aircraft convertible for land or seaplane duties with interchangeable wheel and float undercarriages. Intended primarily for catapult launching from warships, the SO3C-1 was not an unqualified success. It saw limited operational service, and was, in fact, outlived by the aircraft that it was intended to supplant.

Design work on this successor to the SOC Seagull began in 1937, and at the same time, Chance Vought began work on a generally similar aircraft to meet the same requirement. Both manufacturers received prototype development contracts, that for the Curtiss design being placed on May 9, 1938, the prototype, designated XSO3C-1 flying for the first time on October 6, 1939, with a Ranger XV-770-6 engine. This was preceded by the



The XSO3C-1 with wheel (above, right) and float (below) undercarriages.



The SO3C-1 entered service with the U.S. Navy in the summer of 1942, but its operational career was short-lived.

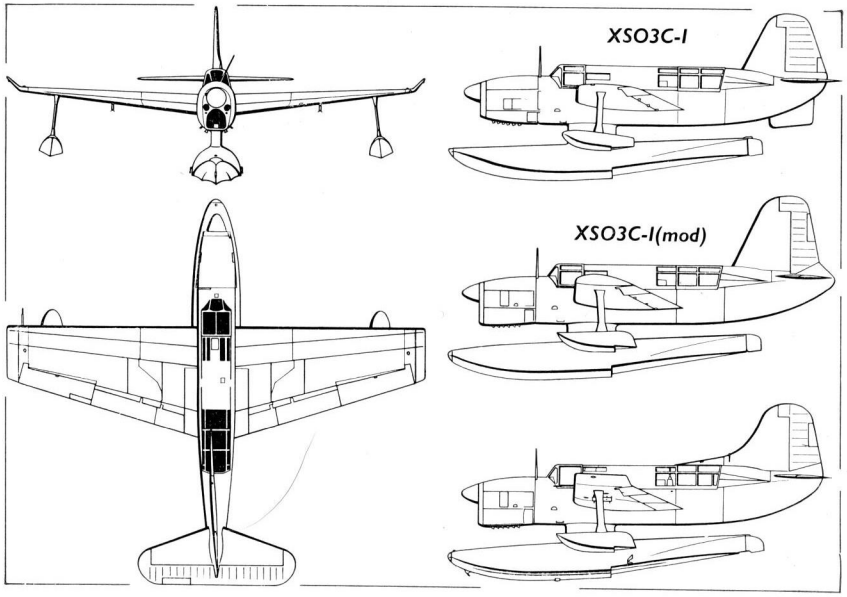
Vought XSO2U-1 with a Ranger XV-770-4 engine by some three months. The XSO3C-1 was flown initially with a narrow-track spatted wheel undercarriage which was fitted to the float attachment structure, loaded weight being 5,489 lb. The aircraft was subsequently flown as a floatplane, but in both configurations the XSO3C-1 encountered stability problems.

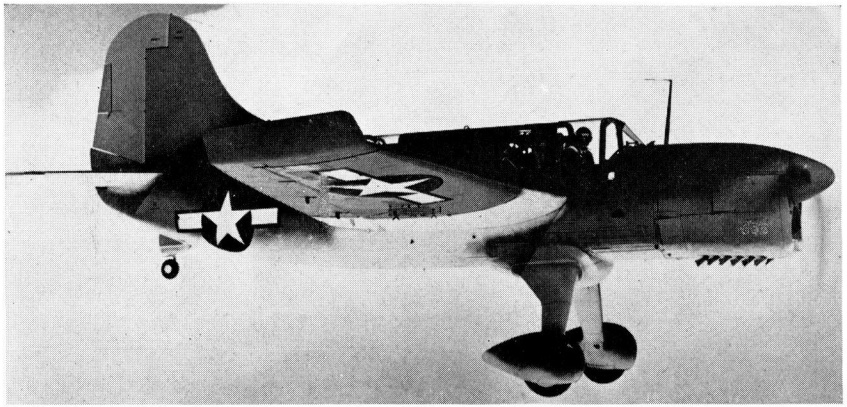
While undergoing trials as a floatplane, a large ventral fin was added to the rear fuselage and, subsequently, the vertical tail surfaces were redesigned and enlarged. As flight testing progressed, it became increasingly obvious that the existing wing dihedral was insufficient, but since increasing dihedral would have demanded considerable modifications to the structure, the effect of increased dihedral was obtained by turning up the wingtips.

Curtiss-Wright's Columbus plant was designated the prime producer of the SO3C-1, but owing to the protracted flight trials of the XSO3C-1 and the need to introduce a number of modifications, deliveries did not begin until mid-1942, the first production SO3C-1 being received by the U.S.S. *Cleveland* on July 15, 1942. The SO3C-1 was powered by a Ranger V-770-6 twelve-cylinder inverted-Vee air-cooled engine offering 600 h.p. for take-off and possessing a normal rating of 450 h.p. between sea level and 11,800 ft. The aircraft was of all-metal construction, the fuselage being a monocoque with a flush-riveted Alclad skin, and the outer sections of the wings swivelled on the rear spar at approximately one-third span for shipboard stowage. The large single-

step metal float was attached to the fuselage by a single cantilever pylon, and the outboard stabilising floats were each attached to the wings by a single cantilever strut. The central float could be replaced by a wheel landing gear of single-strut cantilever type, and racks were provided beneath the wings for two 100-lb. bombs or two 325-lb. depth charges.

The Columbus plant completed production of the SO3C-1 in 1942, three hundred aircraft of this type being delivered, and had also produced the first seven examples of a new model, the SO3C-2, before the end of the year. In addition to its primary role of scout-observation floatplane operating from the catapults of battleships and cruisers, the SO3C-1 was intended for anti-submarine and inshore patrol in its landplane version, but to carry two 325-lb. depth bombs for these tasks it was necessary to remove the pilot armour





One of the forty-four SO3C-3 aircraft which brought production of the basic design to an end in January 1944.

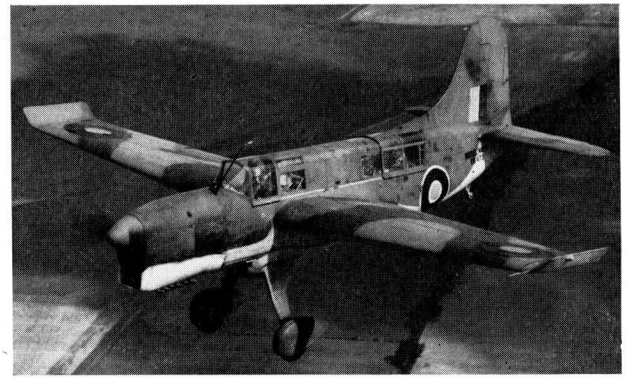
and the flexible 0.3-in. gun with its ammunition together with the fuselage fuel tank, and replace the self-sealing oil tank with one of non-self-sealing type. The narrow-track undercarriage was set so far aft that a very steep ground angle resulted, and ground handling and landing characteristics were difficult, shortcomings which, coupled with a generally poor performance and poor flying characteristics, did not make for popularity. In consequence, a substantial number of the SO3C-1s built were converted as SO3C-1K radio-controlled target drones. At one time, the Ryan Aeronautical Company was also to have produced the aircraft under the designation SOR-1, the Ryan variant incorporating a number of design changes aimed at improving the flying characteristics. The SOR-1 was to have had the upturned wingtips removed, the wing being set at a more pronounced dihedral angle and being markedly tapered from half-span. In the event, production of the SOR-1 was cancelled before any aircraft of this type could be completed.

The SO3C-2 differed from the -1 in having catapult provisions and an arrestor hook for carrier operations, and in its landplane form introduced a fuselage bomb rack which could carry a single 500-lb. bomb. Weighing approximately 105 lb. more than the SO3C-1, the -2 began to leave the assembly line at the end of 1942, a total of 449 SO3C-2s being produced in 1943 to bring total production of this variant to 456 machines. Two hundred and fifty of these were scheduled to be delivered to Britain for use by the Fleet Air Arm as the Seamew I, but only some 150 machines actually reached the United Kingdom where

they saw no operational service, serving in the training role with F.A.A. establishments both at home and in Canada. The version supplied to the F.A.A. was designated SO3C-2C, and this service also received thirty SO3C-1K target drones which were known as Queen Seamews.

In an attempt to improve the performance of the basic design, Curtiss-Wright produced the SO3C-3 which, some thirty pounds lighter than the SO3C-2 and having no provision for catapult operations, had a V-770-8 engine which had a normal rating of 500 h.p. from sea level to 8,100 ft. Forty-four SO3C-3s were built to bring total production of all versions of the aircraft to eight hundred machines, the last being delivered in January 1944, shortly before the type was withdrawn from service with the U.S. Navy. The final developments of the basic design were the SO3C-4 and -4B, some of which were originally scheduled for delivery to the Fleet Air Arm as the Seamew II, but these were not proceeded with.

The following specification relates to the SO3C-2, figures in parentheses relating to the landplane version.



The Royal Navy received a number of SO3C-2 which were dubbed Seamew I, but these saw no operational service, being relegated to the training rôle.

Type: *Two-seat Scout-observation and Patrol Float Seap ane.* **Power Plane:** *One* 600 *h.p. Ranger V-*770-6 *twelve-cylinder inverted-Vee air-cooled engine.* **Armament:** *One fixed forward-firing* 0.3-*in. Colt-Browning machine gun with* 500 *rounds and one flexible* 0.3-*in. gun with* 600 *rounds plus two* 100-*lb. or* 325-*lb. bombs.* **Performance:** *Maximum speed,* 150 (164) *m.p.h. at sea level,* 167 (182) *m.p.h. at* 11,800 *ft.; economic cruising speed,* 117 (121) *m.p.h. at* 1,500 *ft.; initial climb rate,* 380 (520) *ft./min.; time to* 10,000 *ft.,* 26.3 (19.2) *min.; maximum range with* 111 (100) *Imp. gal.,* 640 (630) *mls., with* 164 (188) *Imp. gal.,* 940-(1,165) *mls.; service ceiling,* 16,500 (18,200) *ft.* **Weights:** *Empty,* 4,995 (4,785) *lb.; normal loaded,* 6,600 (6,350) *lb.; maximum,* 7,000 *lb.* **Dimensions:** *Span,* 38 *ft.* 0 *in.; length,* 34 *ft.* $8\frac{7}{8}$ *in.* (33 *ft.* $9\frac{1}{4}$ *in.); height,* 14 *ft.* 2 *in.* (10 *ft.* 0 *in.); wing area,* 293 *sq. ft.*

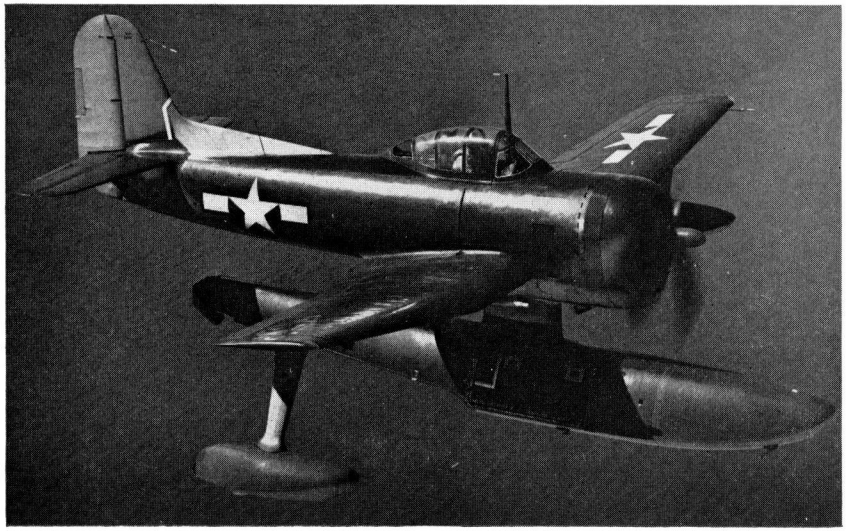
CURTISS SC-1 SEAHAWK

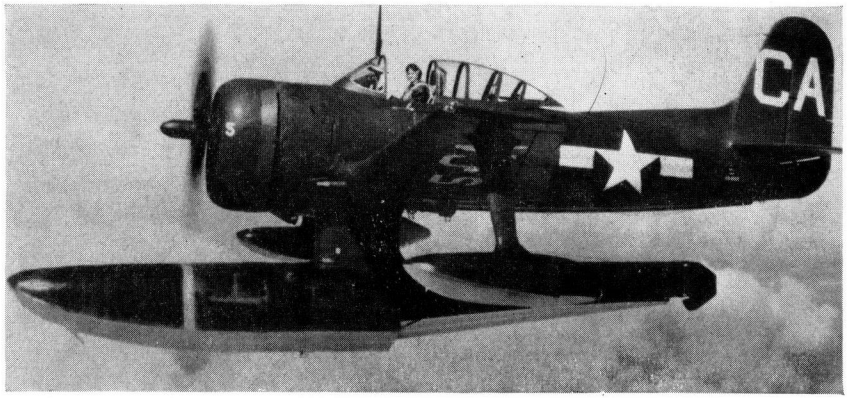
U.S.A.

The last of a line of single-float shipboard seaplanes designed and built for the U.S. Navy by the Curtiss-Wright Corporation, the SC-1 Seahawk was developed to succeed the SO3C and OS2U aboard catapult-equipped warships. Design development began in June 1942 after the U.S. Navy had approached Curtiss-Wright with a request for proposals for a single-seat scout for use as standard equipment aboard the U.S. Navy's battleships and cruisers. A contract for seven prototypes was placed on March 31, 1943, two of these being intended for flight development and the remaining five for equipment development and service evaluation.

Designated XSC-1, the first prototype was flown on February 16, 1944, and within seven weeks the remaining six prototypes had been flown by Curtiss's Columbus facility. Powered by a Wright R-1820-62 nine-cylinder radial engine with turbo-supercharger and rated at 1,350 h.p. for take-off and 1,300 h.p. at 26,800

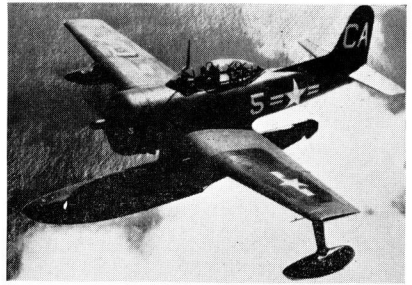
The SC-1 Seahawk entered service with the U.S. Navy late in 1944, being delivered to the U.S.S. Guam in October of that year.



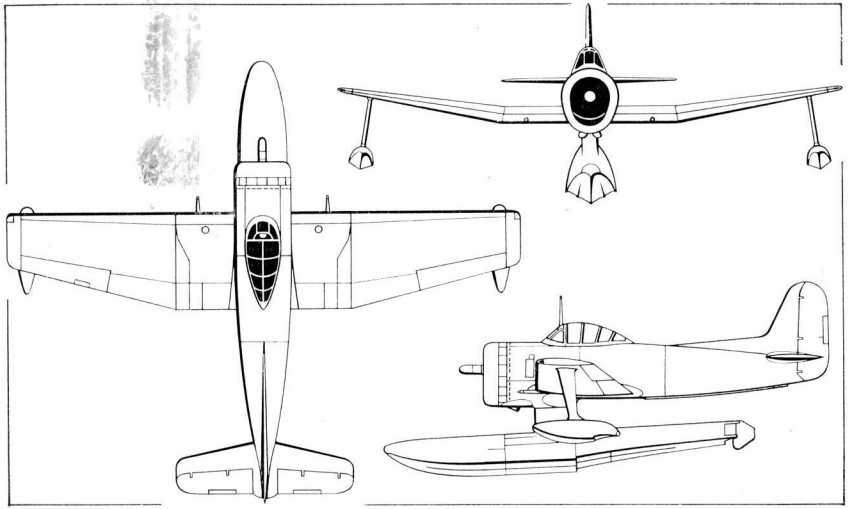


The SC-1 Seahawk was first officially reported in action during the pre-invasion bombardment of Borneo.

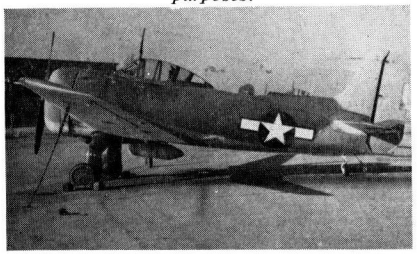
ft., the XSC-1 was of all-metal stressed-skin construction with a single central main float and a stabilising float at each wingtip. Although basically a single-seater, a bunk could be fitted in the fuselage aft of the pilot's seat into which a man could crawl, thus enabling the aircraft to be used for the air-sea rescue role. Two 100-lb bombs could be carried in the central float which was equipped with bomb doors actuated from the cockpit, and two 250-lb. bombs could be attached to racks under the wing centre section. Alternatively, the underwing racks could carry one 250-lb. bomb and an ASH radar container. Provision was made for the attachment of a fixed wheel landing gear for ferrying operations, the same attachment points being used for both wheel and float gears.



The first production delivery of the SC-1 Seahawk was made to the U.S.S. *Guam* on October 22, 1944, although the type was not officially reported in action until the pre-

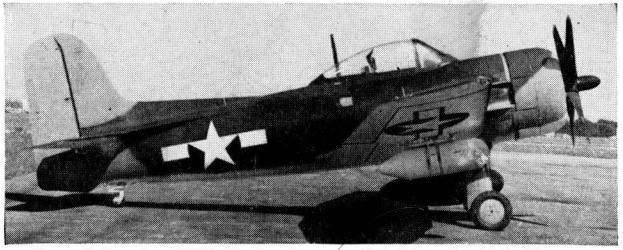


An SC-1 with wheel undercarriage for ferrying purposes.



invasion bombardment of Borneo in June 1945. One hundred and fifteen production machines had been delivered by the Columbus plant by the end of 1944, and a further 435 were completed in 1945, together with two XSC-1As and two XSC-2As. The XSC-2 was a two-seat version with wider utility for scouting and rescue work, and externally it differed from the SC-1 in having the original oval-section forward fuselage and cowling supplanted by a circular-section fuselage and cowling; the framed canopy replaced by a free-blown canopy; a rudder of higher aspect ratio; repositioned radio mast; anti-spin

extensions to the tailplane and horn-balanced elevators; cowling gills of greater chord, and exhaust outlets removed from the fuselage belly and inserted in the fuselage sides. A 1,425 h.p. R-1820-68 engine supplanted the R-1820-62, and provision was made for the installation of camera equipment. Only nine SC-2 Seahawks were completed for the U.S. Navy, the last of these being delivered in October 1946 to bring total Seahawk production to 577 aircraft.



One of the nine SC-2 Seahawks completed for the U.S. Navy.

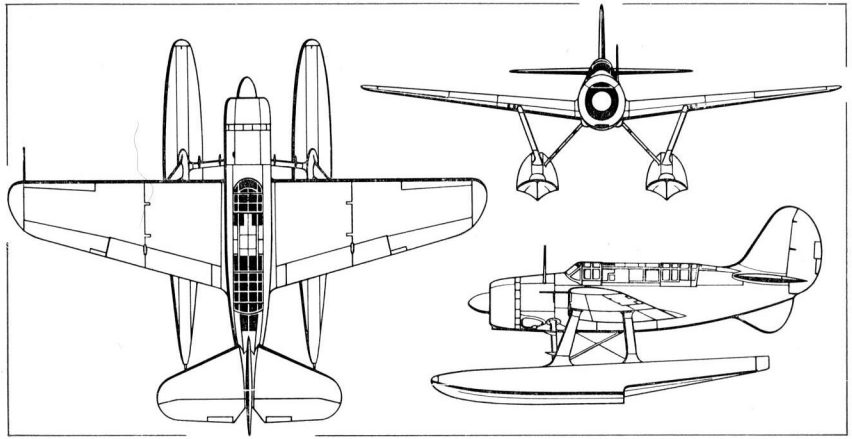
The following specification relates to the SC-1 Seahawk.

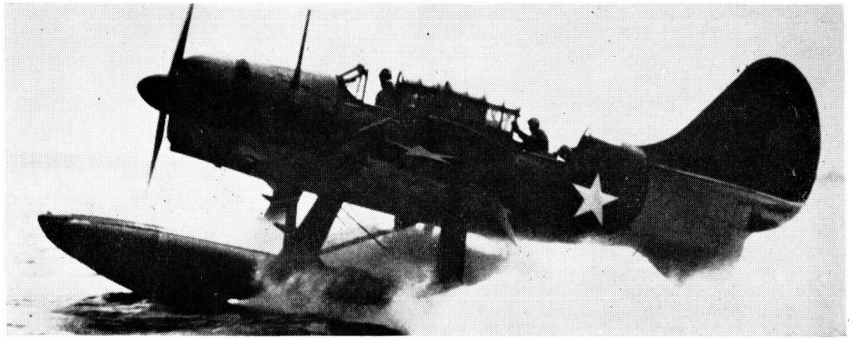
Type: *Single-seat Shipboard Scout and Air-sea Rescue Float Seaplane.* **Power Plant:** *One* 1,350 *h.p. Wright R*-1820-62 *Cyclone nine-cylinder radial air-cooled engine.* **Armament:** *Two* 0.5-*in. Colt-Browning machine guns with* 800 *r.p.g., plus two* 250-*lb. and two* 100-*lb. bombs.* **Performance:** *Maximum speed,* 313 *m.p.h. at* 28,600 *ft.,* 238 *m.p.h. at sea level; range,* 625 *mls. at* 125 *m.p.h.,* (*with* 80 *Imp. gal. auxiliary tank in central float*), 1,090 *mls. at* 129 *m.p.h.; initial climb rate,* 2,500 *ft./min.; time to* 10,000 *ft.,* 4.1 *min., to* 20,000 *ft.,* 8.3 *min.; service ceiling,* 37,300 *ft.* **Weights:** *Empty,* 6,320 *lb.; normal loaded,* 7,936 *lb.; maximum,* 9,000 *lb.* **Dimensions:** *Span,* 41 *ft.* 0 *in.; length,* 36 *ft.* 4½ *in.; height,* 18 *ft.* 0 *in.; wing area,* 280 *sq. ft.*

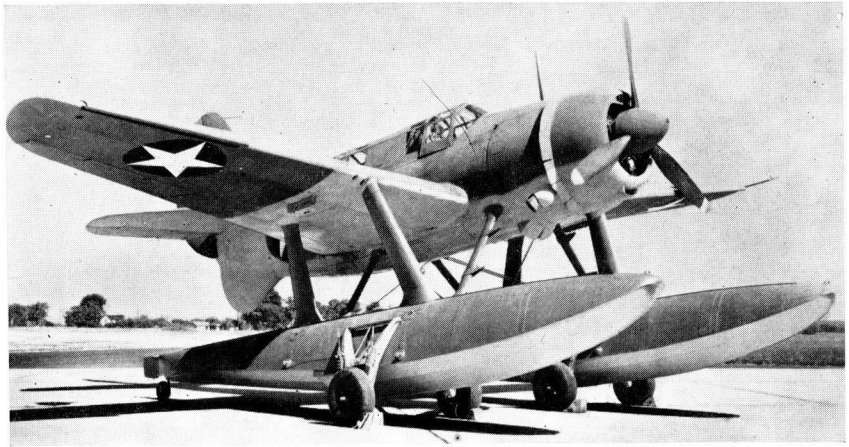
CURTISS XSB2C-2 HELLDIVER U.S.A.

The possibility of producing a twin-float seaplane version of the Curtiss SB2C-1 Helldiver two-seat reconnaissance and dive bomber was first considered early in 1942, shortly after the beginning of the Pacific War. The Japanese Navy was already making extensive use of such warplanes in the Pacific, operating these from coral lagoons while airstrips for land-based aircraft were under construction, and although the rapid growth of the U.S. Navy's carrier force was to render the introduction of float-equipped fighters and bombers unnecessary, some importance was attached to their development when work began on the Helldiver floatplane, the XSB2C-2.

Although the first production SB2C-1 Helldiver did not fly until June 1942, the Edo Corporation had already designed and manufactured a pair of floats for the aircraft and, in consequence, one of the first production SB2C-1 airframes was taken from the assembly line for conversion and, as the XSB2C-2 floatplane, was completed late in September 1942. Retaining the same armament as the SB2C-1, the XSB2C-2 weighed some 1,350 lb.







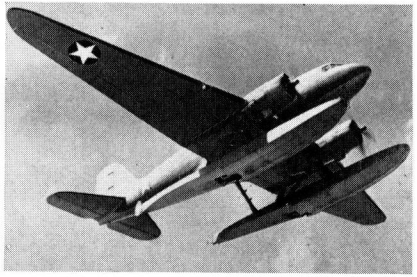
The XSB2C-2 did not enter production owing to the more pressing need for the standard SB2C-1 and a lessening of interest in combat floatplanes.

more than its land-based counterpart in empty condition, and the immense single-step floats which were attached to the wing centre section and the fuselage by four pairs of sloping struts were actually longer overall than the fuselage of the aircraft itself. A curved ventral fin was added to the rear fuselage, but in other respects the XSB2C-2 was identical to the SB2C-1.

Official evaluation trials with the XSB2C-2 began early in 1943, but production of the urgently-needed standard SB2C-1 Helldiver proved slow in gaining momentum, and this, together with a lessening of interest in combat floatplanes, resulted in the decision to discontinue development of the Helldiver floatplane, and no further examples were produced.

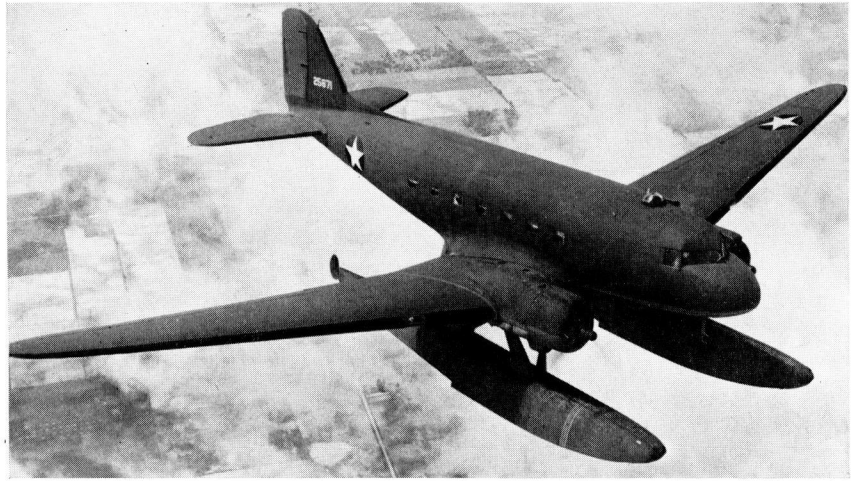
Type: *Two-seat Reconnaissance-bomber Float Seaplane.* **Power Plant:** *One* 1,700 *h.p. Wright R-*2600-8 *fourteen-cylinder radial air-cooled engine.* **Armament:** *Four fixed forward-firing* 0.5-*in. Colt-Browning machine guns with* 400 *r.p.g. and one flexible* 0.5-*in. gun with* 500 *rounds, plus a* 1,000-*lb. bomb load.* **Performance:** *Maximum speed,* 247 *m.p.h. at* 14,100 *ft.; initial climb rate,* 1,190 *ft./min.; service ceiling* 18,400 *ft.; maximum range,* 1,200 *mls.* **Weights:** *Empty,* 11,428 *lb.; normal loaded (reconnaissance),* 14,882 *lb., (bomber),* 15,172 *lb.; maximum overload,* 18,000 *lb.* **Dimensions:** *Span,* 49 *ft.* 9 *in.; length,* 41 *ft.* 0 *in.; height,* 20 *ft.* 10 *in.; wing area,* 422 *sq. ft.*

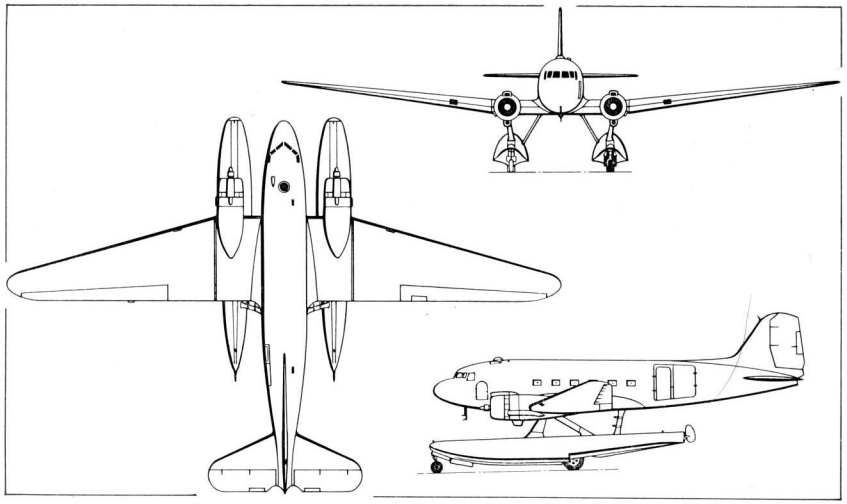
DOUGLAS C-47C SKYTRAIN U.S.A



During 1943, with the object of extending the versatility of the Skytrain transport, a C-47A was fitted with Edo Model 78 amphibious float gear. The all-metal single-step floats, which were mounted just inboard of the engine nacelles, each had two retractable wheels, one in the region of the step and one in the extreme nose, and the space between the two midship bulkheads in each float was used as a 250 Imp. gal. auxiliary tank.

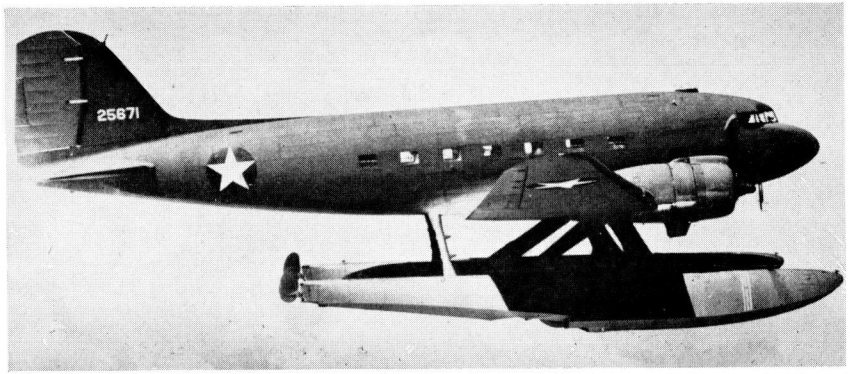
American Airlines at La Guardia Field, Long Island, undertook the necessary modifications, and the cockpit and general layout of the aircraft were unaffected by the installa-





tion of the floats, the normal undercarriage retraction and extension controls being used for the wheels in the floats, although the standard hydraulic accumulator was inadequate to handle the increased size of the hydraulic system, and an extra accumulator had to be installed. Redesignated C-47C, the converted transport flew for the first time at La Guardia Field at the beginning of June 1943, and on the 13th of that month was flown to Wright Field for evaluation.

Trials indicated that taxiing and take-off on land were entirely satisfactory with any load from 25,000 lb. to 29,800 lb., and that the aircraft handled well on the water. The C-47C was very much easier to land than the conventional C-47A landplane, and on water there was no tendency to porpoise either on take-off or landing. The addition of the floats reduced cruising speed by approximately 30 m.p.h. at sea level, and reduced payload by 3,500-4,000 lb., and the forward movement of the c.g. by comparison with the conventional C-47A made loading somewhat critical. During Wright Field trials the brakes were found to be over sensitive and to possess very little "feel", and this resulted in over-braking on one landing which wore through the tyre of the starboard mainwheel and rendered the port mainwheel tyre unserviceable. On one



Although the C-47C completed its trials successfully, loading difficulties resulted in the abandoning of development of this amphibious transport.

occasion a very serious leak developed in the wheel well of the starboard float, water flooding the outboard compartment of the well and the compartment directly aft, this necessitating the design of baffle plates to eliminate any recurrence of the leak. Some trouble was experienced loading the C-47C as it had a tendency to tip backwards if too much weight was placed aft, and the usual C-47 cargo ramp could not be used because of the increased height of the door above the ground.

Tests with the C-47C were continued for some months, but there were indications that servicing would present problems. For example, changing a tyre necessitated two 9-ft. 20,000-lb. jacks and six 2-ft. jacks, the transport having to be raised on an even keel forty-nine inches in order to remove the wheel. Ramps and docks were necessary to facilitate handling and loading, and as it had been envisaged that the amphibious transport would be suited for supplying task forces on small Pacific islands where facilities were limited, no further conversions were undertaken and further trials with the C-47C abandoned.

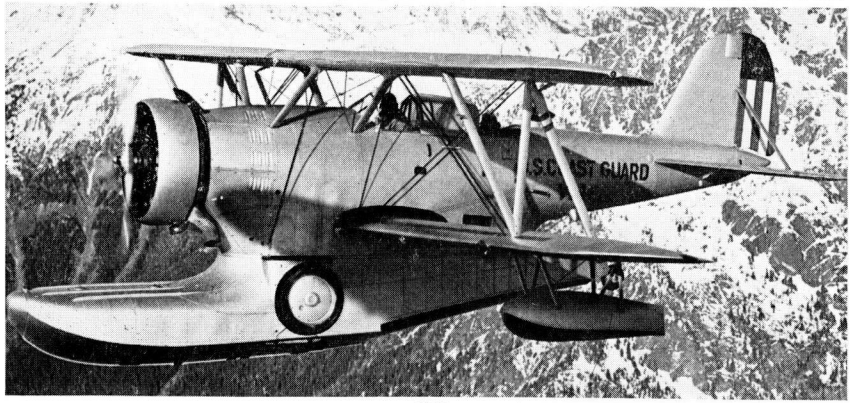
Type: *Amphibious Transport Floatplane.* **Power Plants:** *Two* 1,200 *h.p. Pratt and Whitney R*-1830-92 *Twin Wasp fourteen-cylinder radial air-cooled engines.* **Performance:** *Maximum speed,* 192 *m.p.h. at* 5,000 *ft.,* 185 *m.p.h. at* 10,000 *ft.; cruising speed,* 159 *m.p.h. at* 5,000 *ft.,* 157 *m.p.h. at* 10,000 *ft.; initial climb rate,* 750 *ft./min.; time to* 5,000 *ft.,* 6.5 *min., to* 10,000 *ft.,* 13.6 *min., to* 15,000 *ft.,* 24.4 *min.* **Weights:** *Loaded,* 29,800 *lb.* **Dimensions:** *Span,* 95 *ft.* 0 *in.; length,* 65 *ft.* 4 *in.; height.* 26 *ft.* 9 *in.; wing area,* 987 *sq. ft.*

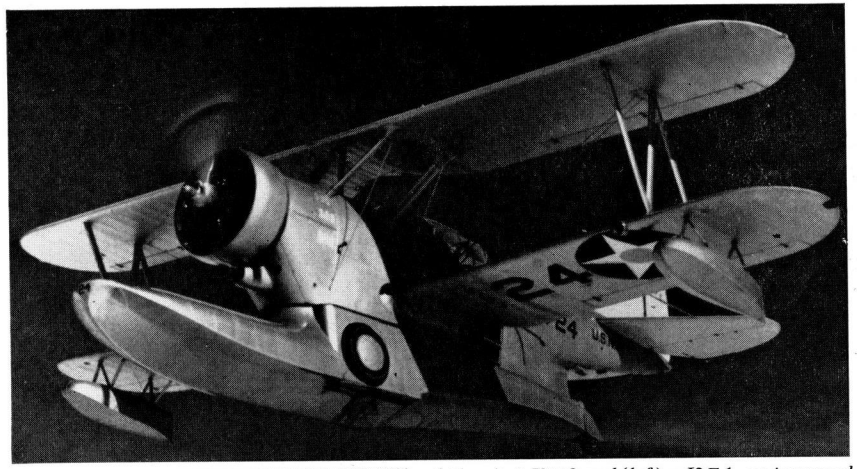
GRUMMAN J2F-1—J2F-6 (DUCK) U.S.A.

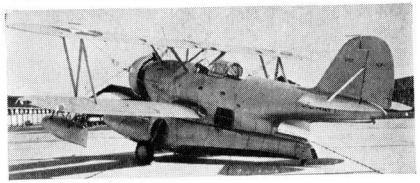
Shortly after the formation of the Grumman Aircraft Engineering Corporation late in 1929, the company evolved a practical aircraft float embodying a retractable wheel undercarriage. Tested on a Chance Vought O2U-1 biplane, this float was embodied in a utility biplane designed to meet U.S. Navy requirements under the designation XJF-1. First flown on May 4, 1933, the XJF-1 was an equal-span staggered single-bay biplane with a metal monocoque stressed-skin fuselage and fabric-covered metal wings. The single-step float faired into the fuselage and the wheels retracted jnto recesses in the sides of the float. Space was provided in the fairing between the fuselage and the central float for wireless and photographic equipment or for a stretcher. Weighing 5,155 lb. in normal loaded condition, the XFJ-1 was powered by a Pratt and Whitney R-1535-62 Wasp engine, and the success of initial trials resulted in an order from the U.S. Navy for twenty-seven production aircraft under the designation JF-1.

The JF-1 differed from the prototype principally in having Pratt and Whitney's fourteen-cylinder two-row R-1830-62 Twin Wasp rated 950 h.p., and the first U.S. Navy unit to re-equip with the JF-1 was VS-3 aboard the U.S.S. *Lexington* which received eighteen amphibians of this type in July 1934, subsequently using them for photographic, target-tug, rescue and ambulance duties. Fourteen essentially similar aircraft but powered by the single-row nine-cylinder Wright R-1820-102 Cyclone engine were supplied to the U.S. Coast Guard under the designation JF-2, and

One of the fourteen JF-2 amphibious floatplanes supplied to the U.S. Coast Guard in 1934–35.





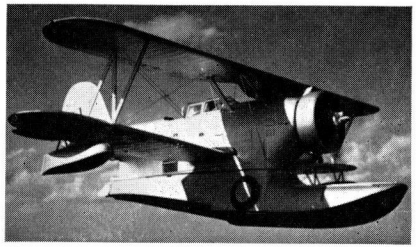


(Above) A J2F-2 and (left) a J2F-1, an improved version of the original JF series.

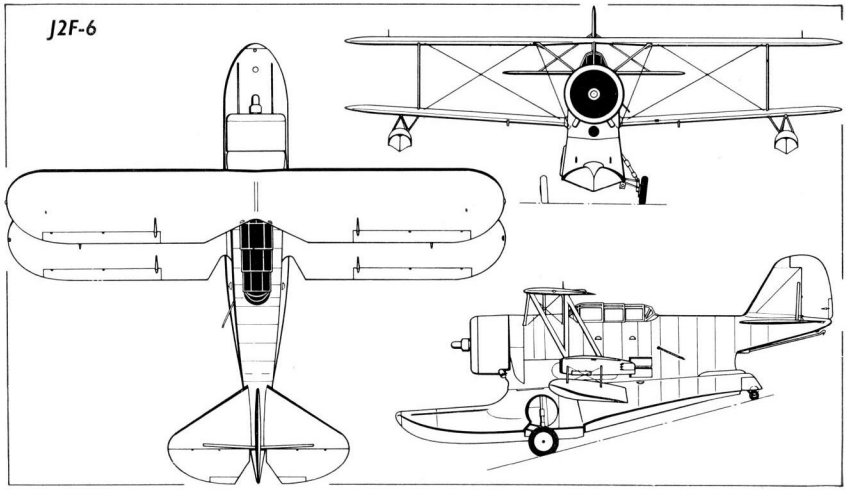
on December 10, 1934, a U.S. Coast Guard pilot established a speed record of 191.796 m.p.h. for amphibians over Chesapeake Bay while flying a JF-2, the highest speed attained during the flight being 196.89 m.p.h. One JF-2 was supplied to the U.S. Marine Corps and eight similar aircraft were purchased by the Argentine government. The U.S. Navy also acquired five Cyclone-powered (R-1820-80) amphibians in 1935 as JF-3s.

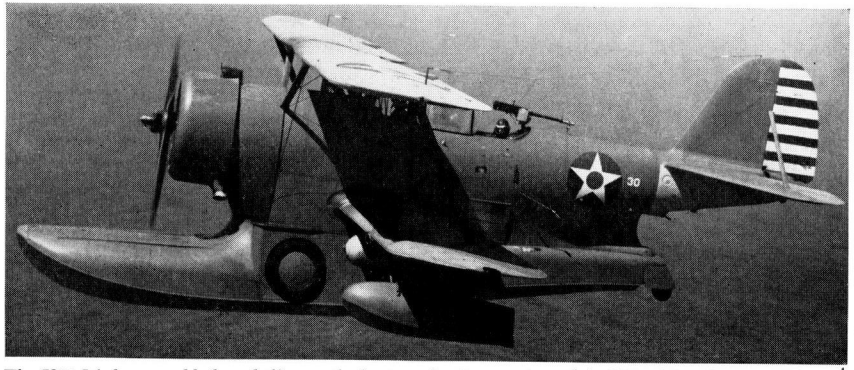
As a successor to the JF-series, the Grumman company evolved an improved version of the basic design specifically for use from carriers and equipped with arrester gear and catapult points. Designated J2F-1 and subsequently known popularly as the "Duck", the new model flew for the first time on June 25, 1935, and eighty-nine aircraft of this type were supplied to the U.S. Navy. The J2F-1 was powered by the R-1820-20 Cyclone engine and weighed approximately one thousand pounds more than the JF-3 in fully loaded condition. Tandem cockpits were

provided for the pilot and observer, and provision was made for accommodating two additional crew members side-by-side in a lower compartment, access to which was provided by a trap in the rear cockpit. The first armed version of the "Duck" to be supplied to the U.S. services was the J2F-2, thirty of which were delivered to the U.S. Marine Corps, although this was not, in fact, the first variant of the basic design to carry armament as the eight JF-2s supplied to Argentina in January-February 1937 were each fitted with a single fixed forward-firing 0.3-in. machine gun and a similar gun on a swivelling mount in the rear cockpit, as well as underwing racks for light bombs.

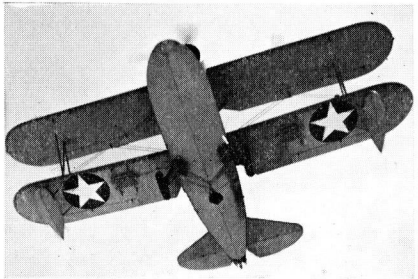


One of twenty-one J2F-3s for the U.S. Navy.





The J2F-5 (above and below, left) was the last production version of the "Duck" to be manufactured by the parent company, production being completed in 1942.



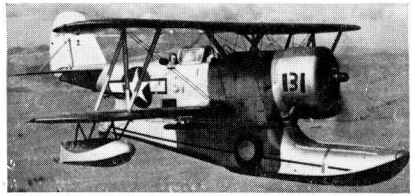
Twenty-one J2F-3s were supplied to the U.S. Navy with R-1820-36 engines featuring increased supercharging, and thirty-nine J2F-4s (R-1820-30) for target-towing duties followed in 1939-40, these completing production of the "Duck" until 1941 when orders were placed for a further 144 amphibians under the designation J2F-5. The J2F-5 was powered by the Wright R-1820-50 Cyclone, and several of the U.S. Navy machines were diverted to the U.S. Coast Guard for air-sea rescue duties while one was delivered to the U.S.A.A.F. for evaluation as the OA-12. Grumman completed sixty-nine J2F-5s in 1941, delivering the remaining seventy-five machines in 1942 when production was transferred to the Columbia Aircraft Corporation of Valley Stream, Long Island.

The Columbia-built version, designated J2F-6, featured some aerodynamic improvements, including a long-chord cowling, and production deliveries began in 1943 with thirteen aircraft, 198 being delivered in 1944, and production terminating in 1945 with a further 119 aircraft, bringing total production of the J2F "Duck" to 653 machines. In addi-

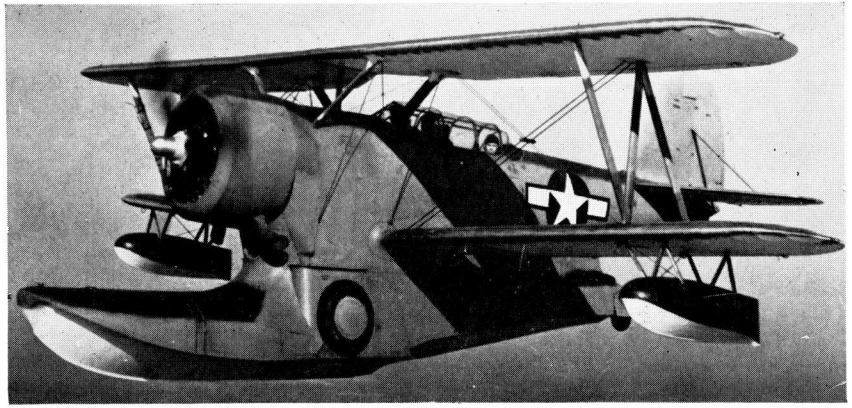
tion to its utility role, the J2F-6 could be used as a photographic aircraft, as a target tug with an MK15-1 sleeve target, and as an anti-submarine patrol aircraft with two 325-lb. depth bombs on underwing racks.

The following specification relates to the final production model, the Columbia-built J2F-6.

Type: *General Utility Amphibian Float Seaplane.* **Power Plant:** *One* 1,050 *h.p. Wright R-*1820-54 *Cyclone nine-cylinder radial air-cooled engine.* **Armament:** *Two* 100-*lb. bombs or two* 325-*lb. depth bombs.* **Performance:** *Maximum speed,* 176 *m.p.h. at sea level,* 190 *m.p.h. at* 14,100 *ft.* (*with bombs*), 184 *m.p.h. as* 14,100 *ft.; maximum cruising speed,* 155 *m.p.h.; economical cruising speed,* 106 *m.p.h. at* 1,500 *ft.; initial climb rate,* 1,330 *ft./min.; time to* 10,000 *ft.,* 8.8 *min., to* 20,000 *ft.,* 22.2 *min.; service ceiling,* 26,700 *ft.; range* (*with* 125 *Imp. gal.*), 675 *mls. at* 106 *m.p.h.* (*with* 158 *Imp. gal.*), 850 *mls. at* 108 *m.p.h.* (*with two* 325-*lb. bombs*), 530 *mls. at* 110 *m.p.h.* **Weights:** *Empty,* 5,445 *lb.; normal loaded,* 7,290 *lb.; maximum,* 7,765 *lb.* **Dimensions:** *Span,* 39 *ft.* 0 *in.; length,* 34 *ft.* 0 *in.; height* 12 *ft.* 4 *in.; wing area,* 409 *sq. ft.*

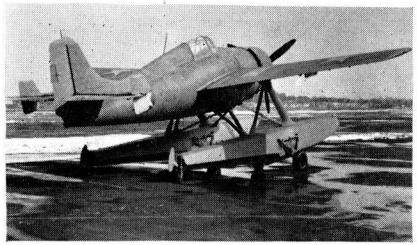


The J2F-6 (below and above, right) was manufactured by the Columbia Aircraft Corporation.



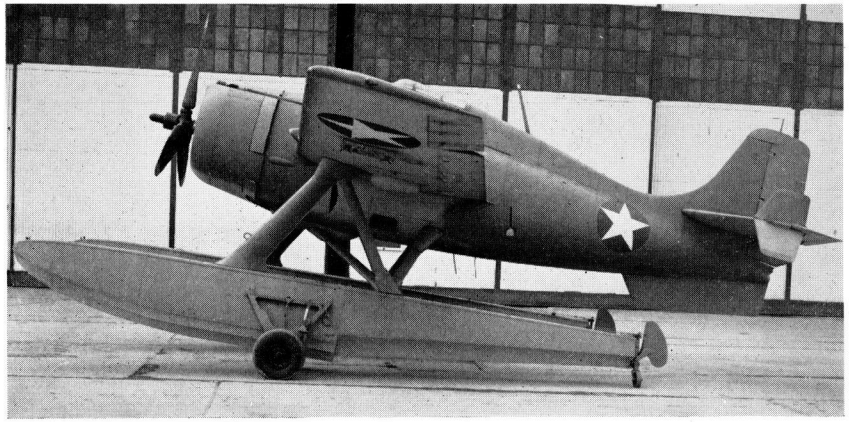
GRUMMAN F4F-3S WILDCAT U.S.A.

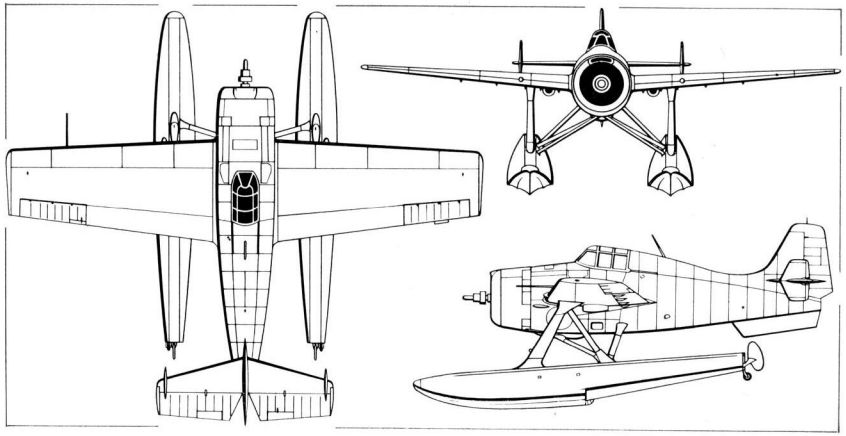
The appearance of the Nakajima-built A6M2-N float fighter in the Aleutians and during the early phases of the assault on Guadalcanal resulted in U.S. Navy interest in an aircraft which, like the Japanese fighter, could operate from sheltered waters and provide air cover pending the availability of airstrips for land-based aircraft. Accordingly, a standard F4F-3 fighter was transferred to the Edo Corporation for conversion as a twin-float seaplane.



Edo designed and manufactured a set of single-step, all-metal floats which were braced to the inboard wing section and fuselage by a rather complex system of struts, and small moveable auxiliary rudders were mounted at the tips of the tailplane, and as the F4F-3S, the

The F4F-3S was intended to provide air cover for task forces pending the availability of airstrips for land-based aircraft. However, the float gear reduced maximum speed by more than 60 m.p.h.





float-equipped Wildcat was flown for the first time on February 28, 1943. Initial trials revealed the need for substantial additional keel area aft to compensate for the large float area forward of the c.g., and in May a large ventral fin was added to improve yaw stability. The floats and their bracing struts raised the fighter's empty weight by only some 500 lb., and in calm water the F4F-3S at 7,506 lb. could take-off in thirty-four seconds. How- the increased drag resulting from the introduction of the float gear reduced maximum speed by more than 60 m.p.h., and as by this time the U.S. Navy's substantially increased carrier force and the construction battalions' proven ability to lay air strips in a remarkably short time had reduced the need for a float-equipped fighter, further development of the F4F-3S was abandoned.

Full details of the land-based versions of the Wildcat fighter are to be found on pages 90-96 of Volume IV.

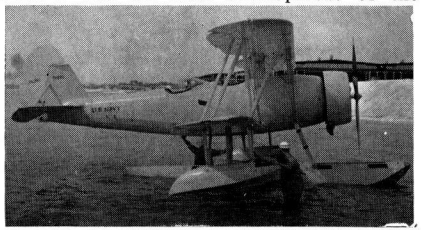
Type: *Single-seat Twin-float Fighter Seaplane.* **Power Plant:** *One* 1,200 *h.p. Pratt and Whitney R*-1830-76 *Twin Wasp fourteen-cylinder radial air-cooled engine.* **Armament:** *Four* 0.5-*in. machine guns with* 800 *r.p.g.* **Performance:** *Maximum speed,* 266 *m.p.h. at* 20,300 *ft.; economical cruising speed,* 132 *m.p.h.; initial climb rate,* 2,460 *ft./min.; time to* 10,000 *ft.,* 4.5 *min.; service ceiling,* 33,500 *ft.; maximum range,* 600 *mls. at* 132 *m.p.h.* **Weights:** *Empty,* 5,804 *lb.; normal loaded,* 7,506 *lb.* **Dimensions:** *Span,* 38 *ft.* 0 *in.; length,* 39 *ft.* 1 *in.; height,* 18 *ft.* 1¾ *in.; wing area,* 260 *sq. ft.*

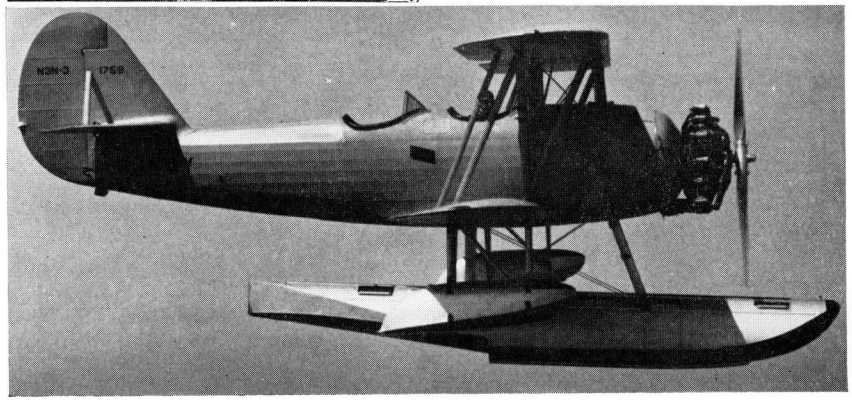
NAVAL AIRCRAFT FACTORY N3N-1—N3N-3 U.S.A.

Destined to outlive all other biplane trainers in service with the U.S. Navy, the N3N-3 produced by the government-owned Naval Aircraft Factory at Philadelphia was the only primary training floatplane to serve with the U.S. forces during the Second World War. Known popularly as the *Yellow Bird*, the N3N-3 was the final development of the XN3N-1 primary training biplane, the design of which was ordered early in 1935. The construction of the XN3N-1 was generally typical of trainers of its period, being a single-bay biplane with splayed N-type struts and an all-metal, fabric-covered structure. Power was provided by a 220-h.p. Wright R-790-8 Whirlwind air-cooled radial, and the aircraft could be operated on wheel or float undercarriage, the latter comprising a single-step central float with outrigger floats beneath the wingtips.

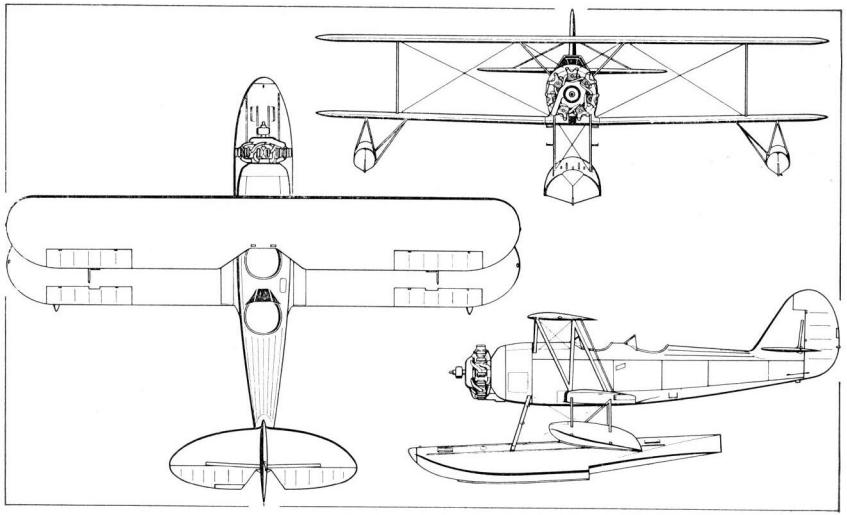
A production order for 185 N3N-1 trainers, including a group to be operated at Pensacola as seaplanes only, was placed in 1935 before the XN3N-1 had been completed, but work on production machines was held up when the prototype revealed a number of stability and control shortcomings which necessitated the redesigning and lengthening of the fuselage and considerable changes to the tail surfaces. These changes were completed late in 1935, and the XN3N-1 began acceptance trials at Pensacola during the early months of 1936. These trials were completed satisfactorily, although it was recommended that the engine cowling be omitted on production trainers in order to improve view forward. By this time, a number of engine cowlings had been manufactured, and some of these were, in fact, fitted to N3N-1 trainers in later years.

The first production N3N-1 was delivered to Anacostia for trials in the summer of 1936, and float-equipped machines were delivered to Pensacola before the end of the year. At an early production stage it was decided to supplant the Wright R-790 by another version of the Whirlwind engine, the R-760-ET rated at 235 h.p. at sea level, and deliveries of the N3N-1 were completed in the spring of 1938. In an effort to evolve an improved model, a completely revised tail assembly was fitted to one aircraft as the XN3N-2, this aircraft having an R-760-96 Whirlwind engine of 240 h.p. driving a variable-pitch airscrew, but the improvement was not sufficient to warrant the introduction of this type in place of the N3N-1 then being delivered.





(Above, left) The XN3N-1 and (below) the N3N-3, known popularly as the "Yellow Bird".



In 1939, when the Naval Aviation Programme resulted in a demand for more training aircraft, the Naval Aircraft Factory resumed production with a modernised model, the N3N-3 which was destined to supplant the -1 for both landplane and seaplane training. While it retained most of the features of the N3N-1, the -3 incorporated newly redesigned tail surfaces while the landplane version had an improved undercarriage. The rapidly expanding U.S. Navy training programme demanded a high rate of production, and a total of 816 N3N-3s was delivered between April 1940 and January 1942 when production was completed. In 1941, the U.S. Coast Guard exchanged with the Navy four of its Grumman JF-2s for four N3N-3s which were required for an accelerated Coast Guard pilot training programme. By mid-1945, all N3N-3 landplane trainers had been declared surplus, but approximately one hundred N3N-3 floatplanes were retained, these continuing in service at Annapolis until they finally succumbed to wear and tear in the late 'fifties, gaining the distinction of being the last biplanes to serve with the U.S. Navy.

Type: *Two-seat Primary Training Float Seaplane.* **Power Plant:** *One* 235 *h.p. Wright R-*760-8 *Whirlwind seven-cylinder radial air-cooled engine.* **Performance:** *Maximum speed,* 112 *m.p.h. at* 3,000 *ft.; cruising speed,* 92 *m.p.h.; initial climb rate,* 680 *ft./min.; service ceiling,* 11,500 *ft.; range,* 440 *mls.* **Weights:** *Empty,* 2,147 *lb.; loaded,* 2,850 *lb.* **Dimensions:** *Span,* 34 *ft.* 0 *in.; length,* 28 *ft.* 3 *in.; height,* 13 *ft.* 6 *in.; wing area,* 305 *sq. ft.*

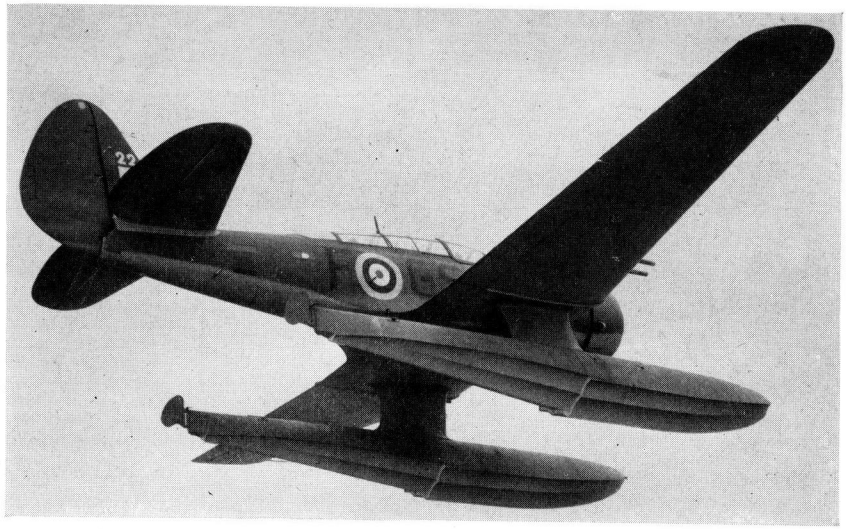
NORTHROP N-3PB

U.S.A.

Designed in 1939, the Northrop N-3PB was the first product of Northrop Aircraft Incorporated which company had been formed in that year by John K. Northrop. A three-seat twin-float seaplane of all-metal construction, the N-3PB owed much to the low-wing single-engined monoplanes evolved by the earlier Northrop Corporation which had been absorbed by the Douglas Aircraft Company, and early in 1940 a Norwegian purchasing commission placed an order for twenty-four floatplanes of this type when the design was still on the drawing board.

The N-3PB had an oval-section all-metal semi-monocoque fuselage with flush-riveted skin, an all-metal stressed-skin wing and two Edo single-step floats attached to the wing centre section by two fully-cantilever pedestals. Power was provided by a Wright R-1820-G205A Cyclone, a similar engine having been

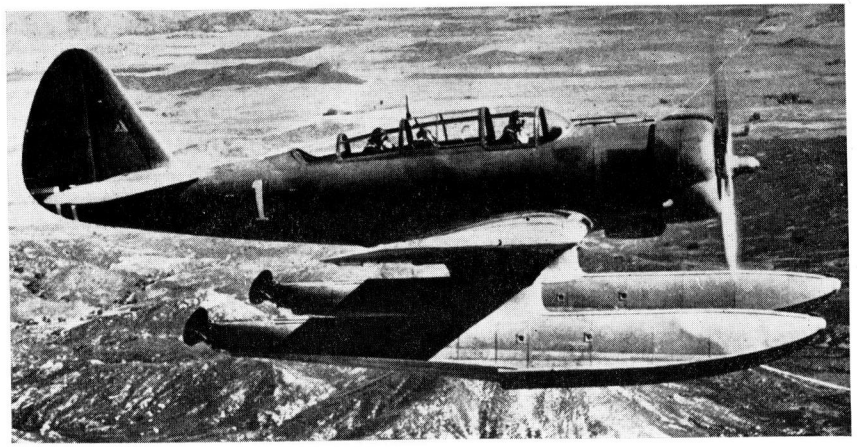
The N-3PB was ordered by the Norwegian government in 1940, *and used briefly by No.* 330 *Squadron.*

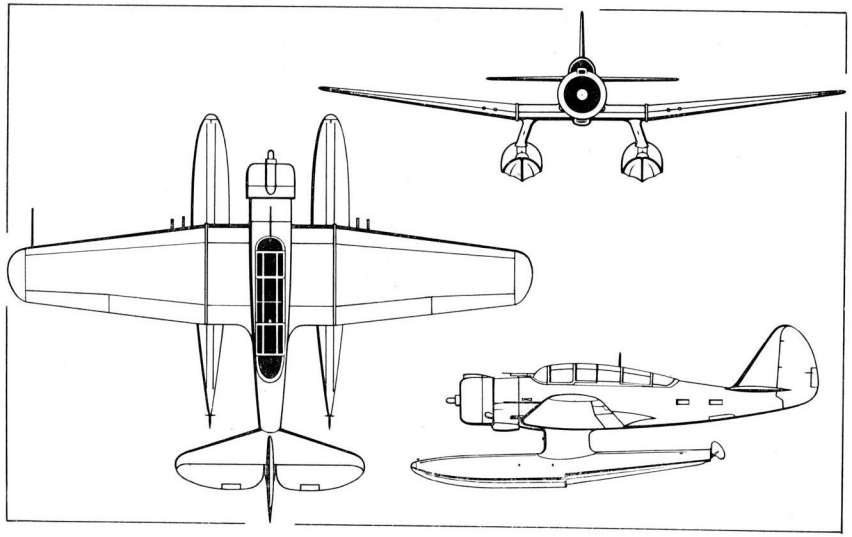


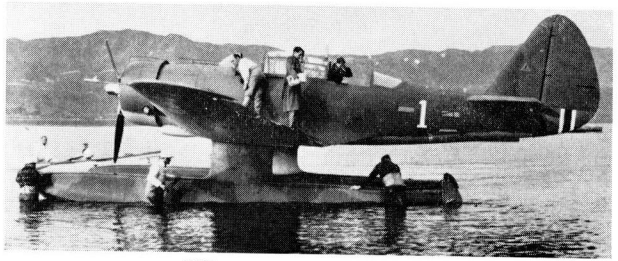
specified for the thirty-six Douglas 8A-5s and thirty-six Curtiss Hawk 75A-8s ordered by the Norwegians at the same time, and offensive armament comprised a 2,000-lb. bomb load or torpedo.

Shortly after the order for the N-3PB floatplanes had been placed German forces invaded Norway, and the country had been overrun by the time the first of these aircraft flew in January 1941. All twenty-four aircraft had been delivered by the end of March, and in the following month, on April 25, 1941, the first Norwegian operational unit, No. 330 Squadron, was officially established, and eighteen of the N-3PB floatplanes were sent to Iceland to operate from three bases with this unit. The N-3PBs were used to escort convoys and for anti-submarine patrols, but it was soon obvious that the floatplanes were unsuited for these tasks, and during the summer of 1942 they were supplanted by six PBY-5 Catalina flying boats which were loaned to No. 330 Squadron by the R.A.F., the N-3PBs subsequently being relegated to the training role.

Type: *Three-seat Patrol-bomber Twin-float Seaplane.* **Power Plant:** *One* 1,100 *h.p. Wright GR*-1820-*G*205*A nine-cylinder radial air-cooled engine.* **Armament:** *Four fixed forward-firing* 0.5-*in. Colt-Browning machine guns with* 267 *r.p.g., one flexible* 0.3-*in. gun with* 1,200 *rounds in dorsal position and one flexible* 0.3-*in. gun with* 1,000 *rounds in ventral position, plus a* 2,000-*lb. bomb load.* **Performance:** *Maximum speed,* 257 *m.p.h. at sea level,* 228 *m.p.h. at* 16,400 *ft.; cruising speed,* 184 *m.p.h.; time to* 15,000 *ft.,* 14.4 *min.; service ceiling,* 24,000 *ft.; range,* 1,000 *mls.* **Weights:** *Empty,* 6,190 *lb.; normal loaded,* 8,500 *lb.; maximum loaded,* 10,600 *lb.* **Dimensions:** *Span,* 48 *ft.* 11 *in.; length,* 36 *ft.* 0 *in.; height,* 12 *ft.* 0 *in.; wing area,* 376.8 *sq. ft.*



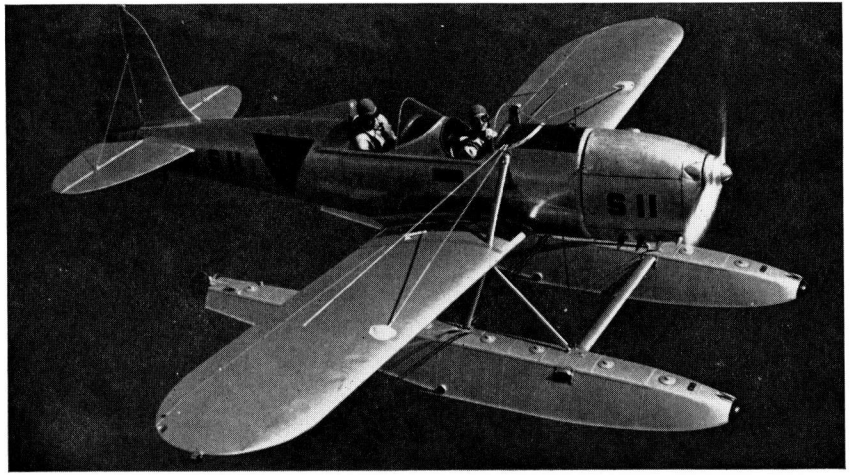


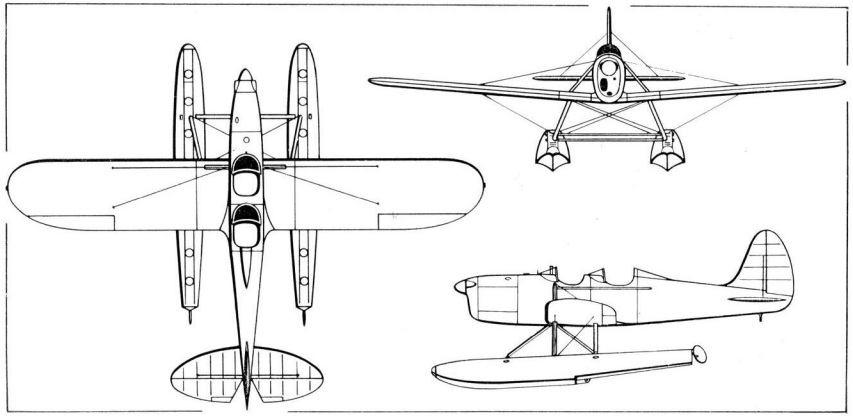


RYAN STM-S2 U.S.A.

With the occupation of the Netherlands in 1940 and increasing evidence of Japanese expansionist intentions in the Pacific, the Air Corps of the Netherlands East Indies Army and the *Marine Luchtvaartdienst* in the Indies initiated an expansion and reorganisation programme, and among orders placed in the U.S.A. in 1940 for military aircraft was one for Ryan STM-2 primary trainers.

The STM-2 was derived from the STM, a military training version of the commercial ST of 1934 sold in substantial numbers to the air forces of Mexico, Honduras, Guatemala, and other Latin American countries in 1938-39, and the improved STM-1 (PT-16A), and was of all-metal construction with an oval monocoque fuselage and two-spar wing with tie-rod bracing. Twenty-four STM-2s were ordered by the Netherlands East Indies government and, at the same time, Ryan were requested to develop a twin-float seaplane variant for which an order for a further twenty-four machines was placed. The floatplane variant, the STM-S2, was fitted with twin Edo single-step light-alloy floats, and deliveries to Surabaya, Java, began early in 1941. Operating from the Morokrembangan Naval Air Base, the STM-S2 floatplanes were used for primary, basic and blind-flying training, but with the beginning of the Pacific War they also served





for harbour patrol and as liaison aircraft. Whenever training was interrupted by Japanese air attacks, the STM-S2s were flown from Morokrembangan to nearby rice paddies which had been flooded to provide emergency bases, and training operations were sometimes combined with high-altitude spotting tasks. Sometimes the unarmed trainers encountered Japanese aircraft and were forced to rely on their manoeuvrability to elude the enemy. On one occasion, a Dutch pilot out-manoeuvred a Japanese fighter for ten minutes in an STM, regaining his base "full of holes and with part of the controls shot away".

After the discontinuation of training in Java, the STM-S2s served to carry badly needed supplies to ships hidden in sheltered harbours and Dutch Army outposts along the island coastline. When the operation of the trainers became too perilous, it was decided to crate the STM-S2 floatplanes and ship them to Australia. However, it was impossible to save the Army Air Corp's land-based STM-2s which were at Bandoeng, and several of these were captured by the Japanese and subsequently used for aerobatic training. Upon their arrival in Australia, the STM-S2 floatplanes were converted to landplanes and operated by the R.A.A.F.

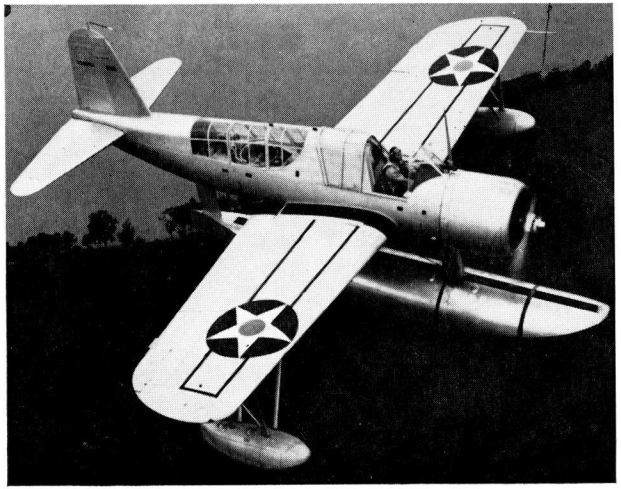
Type: *Two-seat Primary Training Twin-float Seaplane.* **Power Plant:** *One* 150 *h.p. Menasco C-4-S four-cylinder inline inverted air-cooled engine.* **Performance:** *Maximum speed,* 135 *m.p.h. at sea level,* 128 *m.p.h. at* 7,500 *ft.; cruising speed,* 120 *m.p.h. at* 2,000 *ft.; initial climb rate,* 820 *ft./min.; service ceiling,* 16,500 *ft.* **Weights:** *Empty,* 1,214 *lb.; loaded,* 1,740 *lb.* **Dimensions:** *Span,* 29 *ft.* 11 *in.; length,* 23 *ft.* 7⅝ *in.; height,* 8 *ft.* 5 *in.; wing area,* 124 *sq. ft.*

VOUGHT OS2U-1 - OS2U-3 (KINGFISHER) U.S.A.

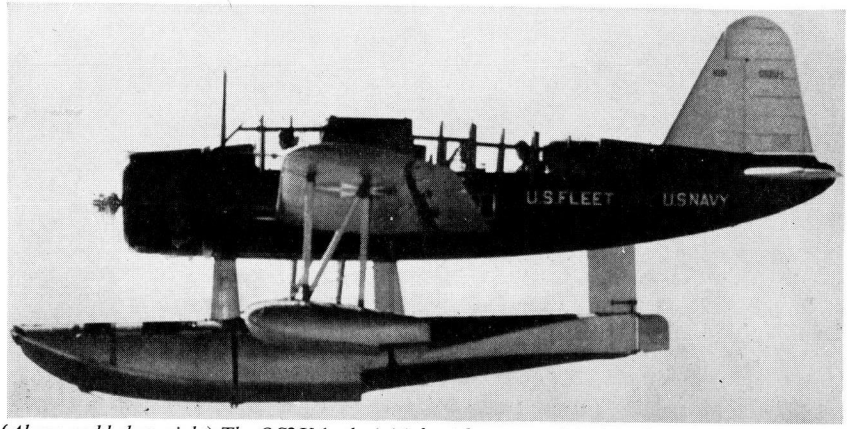
Designed by Rex B. Beisel of the Vought-Sikorsky Aircraft Division of the United Aircraft Corporation (later Chance Vought Aircraft), the VS-310 two-seat observation-scout monoplane was destined to become the "workhorse of the fleet", undertaking a variety of tasks not originally envisaged by its designer or by the specification to which it was designed. Employing the first spot welding of a primary aircraft structure, the VS-310 was also the first aircraft to use a non-buckling fuselage structure, and it stemmed from a contract placed by the U.S. Navy on March 22, 1937, for one prototype of an aircraft designated XOS2U-1.

The XOS2U-1, which flew for the first time on July 20, 1938, was powered by a 450 h.p. Pratt and Whitney R-985-4 Wasp Junior radial air-cooled engine, attained a maximum speed of 177 m.p.h., and had a gross weight of 4,611 lb. A single-step central float was attached to the fuselage by two vertical centre-line struts and bracing wires, and the stabilising floats were each attached to the outboard wing panels by N-struts and two parallel sloping struts. The float gear could be replaced by a fixed, split-type landing gear, each oleo shock-absorbing strut forming one leg of a tripod bolted to fuselage fittings.

The Vought XOS2U-1 photographed on August 11, 1938.



After successful evaluation trials during which a third centre-line strut was added between the aft fuselage and the float, the stabilising floats redesigned and their strut bracing revised, production was begun for the U.S. Navy as the OS2U-1 with the R-985 48 Wasp Junior engine, the first production aircraft flying in April 1940, and the first delivery being made on August 16 of that year to the

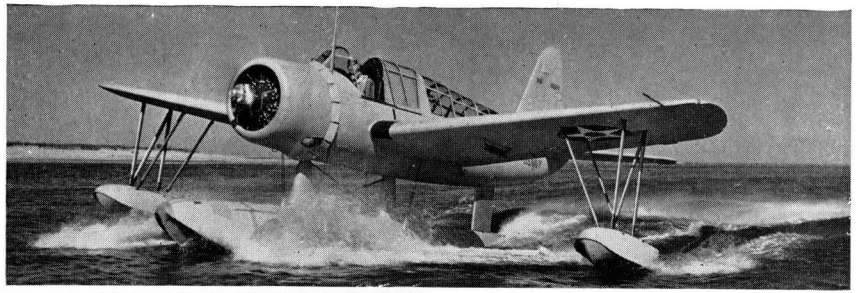


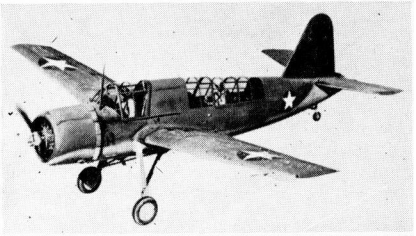
(*Above and below, right*) *The OS2U-1, the initial production model of the floatplane first delivered in* 1940.

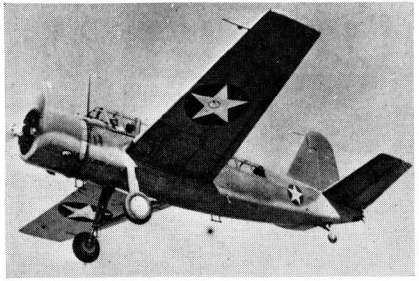
U.S.S. *Colorado*. The OS2U-1 was externally identical to the XOS2U-1 in its final form and had an all-metal monocoque fuselage of riveted and spot-welded construction. The skin panels, reinforced by spot-welded stiffeners, were riveted to two upper longerons and one keel member, and the wing was a single-spar structure with a metal leading edge and covered by fabric aft of the spar.

Fifty-four OS2U-1s were completed by Vought-Sikorsky during 1940, fifteen of these going to the Pensacola Naval Air Station, six going to the Pearl Harbour Battle Force, and twelve going to the Alameda Naval Air Station Battle Force, and the year also saw the delivery of the first two of 158 OS2U-2s which differed primarily in service equipment and in having the R-985-50 engine. Forty-six of the OS2U-2s went to the Pensacola Naval Air Station and fifty-three went to the Jacksonville N.A.S., equipping the new Inshore Patrol Squadrons. The principal production model of the VS-310 was, however, the OS2U-3 which appeared in the summer of 1941.

The OS2U-3 was externally similar to its







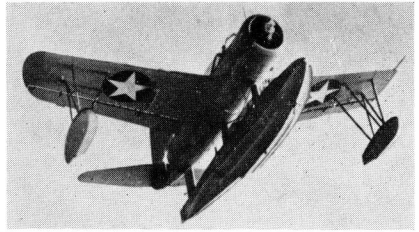
(Above) A standard OS2U-2 and (left) an OS2U-2 experimentally fitted with modified wing and tail surfaces intended for a projected version with a more powerful engine.

predecessors but, powered by either the R-985-AN-2 or -8 Wasp Junior, it featured 31 Imp. gal. self-sealing fuel tanks in the inboard sections of each wing, and 187 lb. of armour for the pilot and observer. Three hundred and sixty-eight OS2U-3s were delivered in 1941, and by the end of that year all observation squadrons had re-equipped with the OS2U. In the following year, when production terminated, a further 638 OS2U-3s were completed by Vought in addition to 300 similar aircraft built by the Naval Aircraft Factory under the designation OS2N-1, the latter being delivered to nine new Inshore Patrol Squadrons formed in 1942. One hundred and fifty-four OS2U-3s were diverted for lend-lease deliveries (of these, twenty were returned to the U.S. Navy), and the Fleet Air Arm was the principal recipient, receiving 100 machines with both float and wheel gear, these entering service as Kingfisher Is.

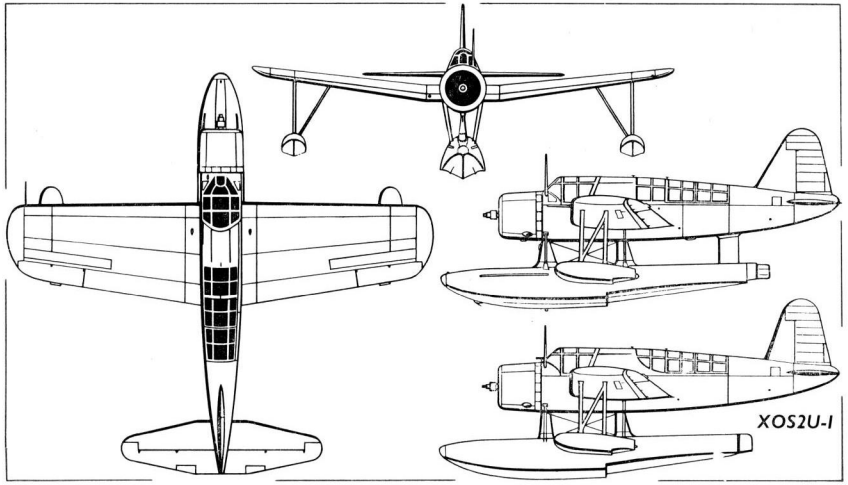
The Kingfisher I reached the United Kingdom in the spring of 1942, the floatplane

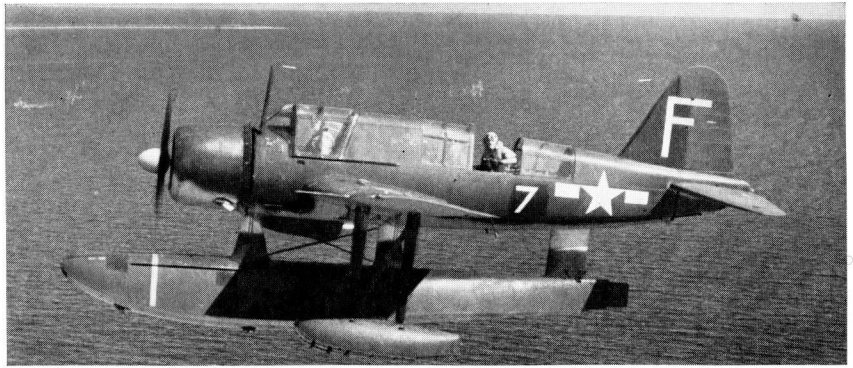
version entering service with No. 703 Squadron. Kingfishers were subsequently used as catapult-launched aircraft with British armed merchant cruisers, but most of those transferred to the F.A.A. saw service as trainers in the West Indies.

The OS2U-3 and OS2N-1 gave the U.S. Navy excellent service in the Pacific, and among their more spectacular exploits was the rescue of Captain Eddie Rickenbacker and his crew in the South Pacific during which the OS2U-3 performing the rescue taxied across forty miles of rough sea to bring them to safety. During an attack on the Japanese in the Aleutians, OS2U-3s served as dive-bombers, carrying fifty per cent in excess of

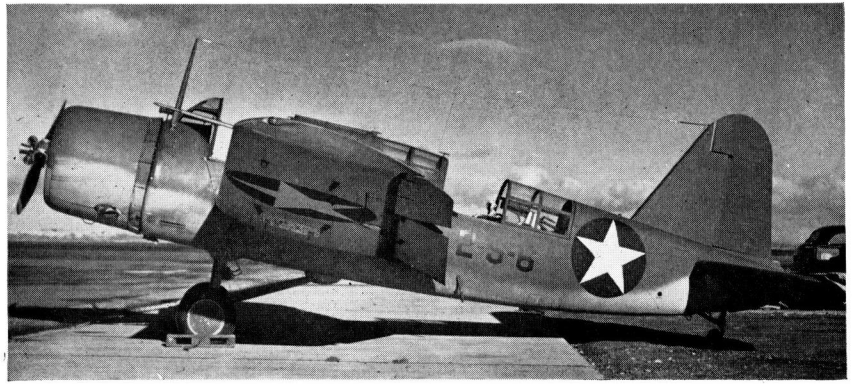


The OS2N-1, three hundred examples of which were produced by the Naval Aircraft Factory to equip new Inshore Patrol Squadrons which were formed in 1942.





The OS2U-3 (above and below) was the principal production model of the Vought floatplane, and gave excellent service in the Pacific where it undertook several spectacular exploits. On one occasion, the OS2U-3 served as a dive bomber.

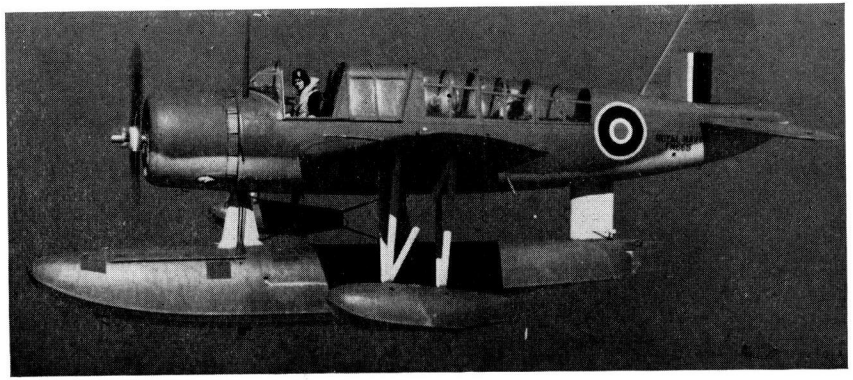


their normal bomb load. Among the roles performed by the OS2U-3 were those of spotting for naval gunfire, reconnaissance, anti-submarine patrol, shipping attack, and liaison, operating from the catapults of battleships and cruisers, from seaplane tenders and from shore bases. During 1942, one OS2U-2 was experimentally fitted with wings of higher aspect ratio with square-cut tips, and a straight-tapered, square-cut tailplane, to check out stability in anticipation of the installation of a larger Wasp engine. In the event, work on the proposed more powerful OS2U was abandoned.

The following specification relates to the OS2U-3 float seaplane, and is generally applicable to the earlier OS2U-1 and -2. Figures in parentheses relate to the OS2U-3 when fitted with a land undercarriage.

Type: *Two-seat Observation and Scout Float Seaplane.* **Power Plant:** *One* 450 *h.p. Pratt and Whitney R-*985*-AN-*2 *or* -8 *Wasp Junior nine-cylinder radial air-cooled engine.* **Armament:** *One fixed forward-firing* 0.3*-in. Colt Browning machine gun with* 500 *rounds and one flexible* 0.3*-in. gun with* 600 *rounds, plus two* 100*-lb. or* 325*-lb. bombs.* **Performance:** *Maximum speed,* 164 (172) *m.p.h. at* 5,500 *ft.,* 157 (165) *m.p.h. at sea level; economical cruising speed,* 119 (125) *m.p.h. at* 5,000 *ft.; time to* 5,000 *ft.,* 12.1 (7.4) *min., to* 10,000 *ft.,* 29.1 (17.1) *min.; service ceiling,* 13,000 (15,500) *ft.; normal range,* 805 (910) *mls. at* 119 (125) *m.p.h.; maximum range with* 172 (201) *Imp. gal.,* 1,155 (1,480) *mls.* **Weights:** *Empty,* 4,123 (3,749) *lb.; normal loaded,* 5,600 (5,265) *lb.; maximum,* 6,000 (5,936) *lb.* **Dimensions:** *Span,* 35 *ft.* 10⅞ *in.; length,* 33 *ft.* 10 *in.* (30 *ft.* 4 *in.*)*; height,* 15 *ft.* 1½ *in.* (8 *ft.* 8 *in.*)*; wing area,* 262 *sq. ft.*

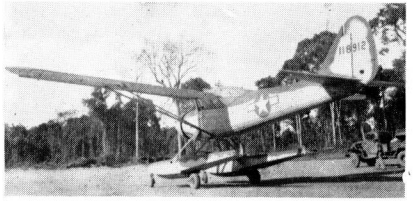
The British Navy received one hundred OS2U-3s which entered service as the Kingfisher I.



VULTEE L-1E AND L-1F VIGILANT

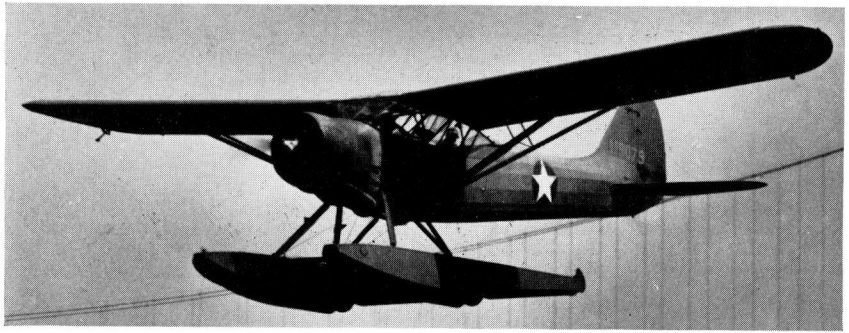
U.S.A.

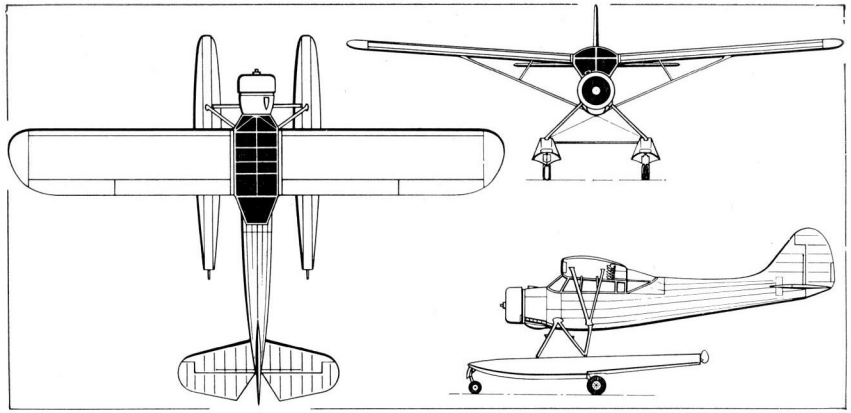
Although the Vigilant was designed solely for the role of two-seat army co-operation and observation landplane, it did gain the distinction of becoming one of the very few amphibious float seaplanes to serve during the Second World War. An all-metal aircraft with a fabric-covered steel-tube fuselage and a two-spar wing covered by light alloy sheet forward of the front spar and aft of the rear spar, and by fabric between the spars, the Vigilant was originally designed by the Stinson Aircraft Division of the Aviation Manufacturing Corporation in 1939. Ordered into production as the O-49, it became the Vultee Model 74 when, in the summer of 1940, the Stinson facilities were taken over by Vultee Aircraft, and in 1942, the U.S.A.A.F. designation for the Vigilant was changed from O-49 to L-1.



The Vigilant possessed exceptional slow-flying characteristics gained by the use of large-area flaps which occupied much of the wing trailing edges and automatically-operated leading-edge slats extending over the entire wing span. Total orders called for 324 machines, the first 142 of these being O-49s (later L-1s) and the remainder being O-49As (later L-1As) in which fuselage length was increased from 33 ft. 2 in. to 34 ft. 3 in. One

(Above) The sole L-1F amphibious floatplane and (below) one of the two L-1E conversions.





hundred and seventy-one Vigilants were completed in 1941, production terminating in 1942, and twenty were supplied to the R.A.F. under Lend-Lease, these serving in Tunisia, Sicily and Italy in 1943-44. Three L-1s were adapted for ambulance duties as L-1Bs, one L-1A was equipped with a special loading hatch in the upper fuselage decking for one stretcher to become the sole L-1C, and twenty-one L-1As were modified as L-1Ds for glider pick-up training.

In the meantime, the Edo Aircraft Corporation had been designing special amphibious float gear for the Vigilant. Known as Model 77 amphibious gear, this comprised two long single-step floats each of which embodied retractable nose and mainwheels. This gear was fitted to two ambulance conversions of the L-1, these being redesignated L-1E, and to one ambulance conversion of the L-1A, this becoming the L-1F, the principal difference between the two models being the greater fuselage length of the L-1F. Although no further conversions of the Vigilant were undertaken, the L-1Es and L-1F served in the casualty evacuation role in Burma in 1944.

The following specification relates to the L-1E, figures in parentheses relating to the L-1F.

Type: *Light Amphibious Ambulance Float Seaplane.* **Power Plant:** *One* 295 *h.p. Lycoming R*-680-9 *nine-cylinder radial air-cooled engine.* **Performance:** *Maximum speed,* 122 (120) *m.p.h. at* 1,500 *ft.; cruising speed,* 86 (83) *m.p.h.; initial climb rate,* 1,080 (1,000) *ft./min.; range,* 300 *mls.* **Weights:** *Empty,* 2,650 (2,662) *lb.; loaded,* 3,325 (3,400) *lb.* **Dimensions:** *Span,* 50 *ft.* 10⅞ *in.; length,* 37 *ft.* 9 *in.* (38 *ft.* 10 *in.*); *height,* 17 *ft.* 2 *in.; wing area,* 328.9 *sq. ft.*

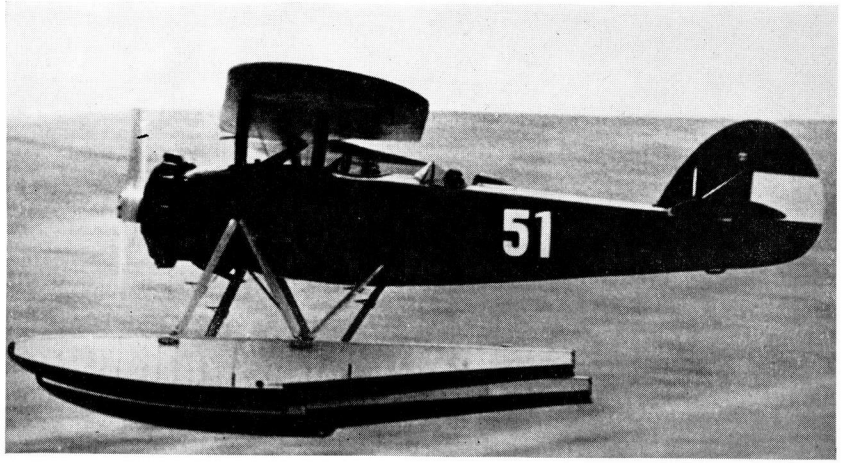
ROGOŽARSKI PVT-H

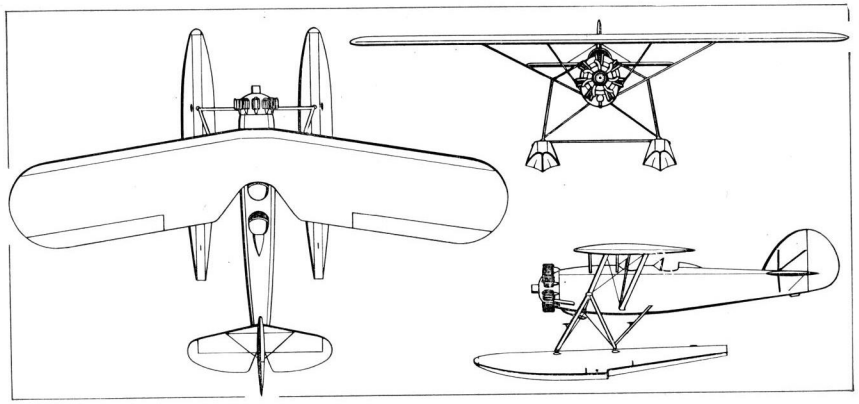
YUGOSLAVIA

Virtually all pre-war Yugoslav fighter pilots from the year 1934 were trained on an exceptionally manoeuvrable two-seat parasol advanced trainer, the PVT (Prototip Vazduhoplovno Tehnički) which had been designed by a team comprising R. Fizir, S. Milutinovič, L. Ilič and K. Sivčev, and was built in quantity by the Rogožarski plant in Belgrade.

The exceptional capabilities of the PVT aroused interest in the Yugoslav Naval Air Service, and in 1936 instructions were given to Rogožarski to convert a PVT trainer as a twin-float seaplane. A pair of standard American Edo floats was fitted, and it was found that no major modifications to the airframe were called for, the prototype, designated PVT-H flying for the first time before the end of the year. The PVT-H was of mixed construction, the wing structure being of wood with steel-tube control surfaces and fabric covering and braced to the fuselage by splayed centre-section struts and parallel sloping struts of steel tube, and the fuselage being a wooden structure to which the light-alloy floats with interconnecting spreader bars were braced by sloping N-struts.

The fitting of a float undercarriage had virtually no effect on the aerobatic qualities of the trainer, and a small number of additional





PVT-H floatplanes were ordered for advanced training at the Navy's flying school, these remaining in service until the German invasion of April 1941 when they were used for liaison purposes until the capitulation.

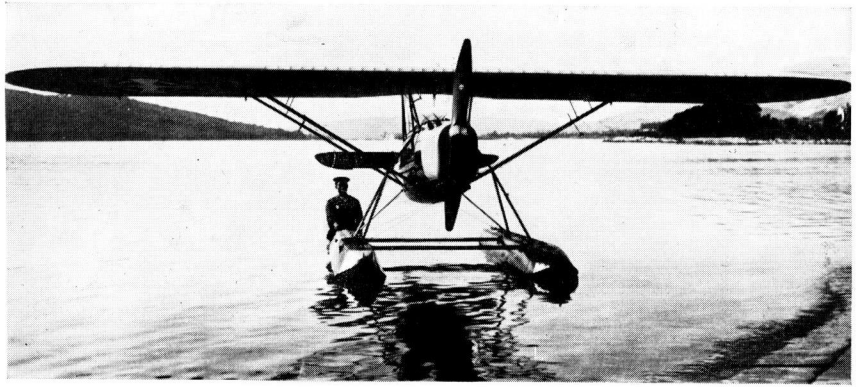
Type: *Two-seat Advanced Training Twin-float Seaplane.* **Power Plant:** *One* 450 *h.p. Gnôme-Rhône 7K Titan-Major seven-cylinder radial air-cooled engine.* **Performance:** *Maximum speed,* 146 *m.p.h. at sea level; cruising speed,* 128 *m.p.h. at* 3,280 *ft.; time to* 3,280 *ft.,* 1 *min.* 30 *sec.; service ceiling,* 20,865 *ft.; range,* 280 *mls.* **Weights:** *Empty,* 2,535 *lb.; loaded,* 3,324 *lb.* **Dimensions:** *Span,* 36 *ft.* 9 *in.; length,* 27 *ft.* 0¾ *in.; height,* 10 *ft.* 4 *in.; wing area,* 237.882 *sq. ft.*

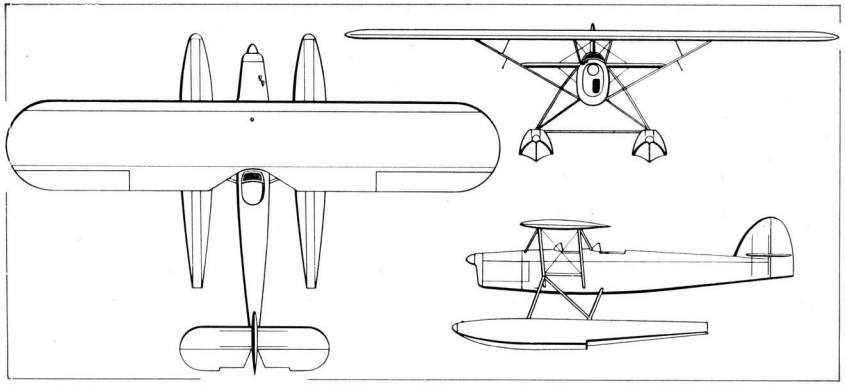
ROGOŽARSKI SIM-XII-H — YUGOSLAVIA

During the late 'thirties, the Royal Yugoslav Air Force training schools introduced a parasol-wing two-seat primary trainer built by Rogožarski, the SIM-X. The Naval Air Service was also in need of a primary trainer of generally similar characteristics and, accordingly, in 1937 the designer, Sima Milutinovič, began the redesign of the aircraft as a primary floatplane trainer. The radial air-cooled engine of the SIM-X was supplanted by the more powerful 190 h.p. Walter Major-Six six-cylinder inline inverted air-cooled engine, some modifications were made to the basic structure, the areas of the vertical and horizontal tail surfaces were increased, and two light alloy Edo floats replaced the fixed wheel undercarriage. In this form and designated SIM-XII-H, the prototype flew for the first time on February 7, 1938, one day before the twin-engined SIM-XIV-H.

The SIM-XII-H was of wooden construction, the one-piece wing being supported above the fuselage by vertical centre-section struts and braced to the bottom of the fuselage by parallel sloping struts, the fuselage being an oval-section monocoque. Successful evaluation of the prototype resulted in an order for four more SIM-XII-H trainers, these being delivered to the naval flying school in 1939, and although intended purely for primary training, they were later fitted with night flying instrumentation and used for night flying training, serving in this role until the German invasion.

Type: *Two-seat Primary Training and Night Flying Training Twin-float Seaplane.* **Power Plant:** *One* 190 *h.p. Walter Major-Six six-cylinder inline inverted air-cooled engine.* **Performance:** *Maximum speed,* 132 *m.p.h. at sea level; cruising speed,* 121 *m.p.h. at* 3,280 *ft.; time to* 3,280 *ft.,* 3 *min.* 12 *sec.; service ceiling,* 16,400 *ft.; range,* 298 *mls.* **Weights:** *Empty,* 1,397 *lb.; loaded,* 2,024 *lb.* **Dimensions:** *Span,* 36 *ft.* 1 *in.; length,* 24 *ft.* 7¼ *in.; height,* 9 *ft.* 8⅛ *in.; wing area,* 220.66 *sq. ft.*

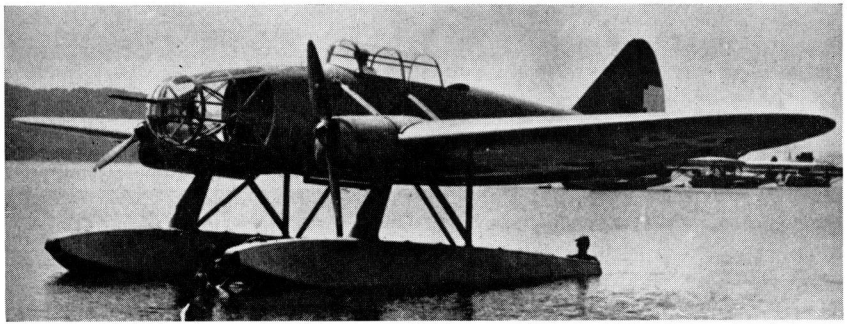




ROGOŽARSKI SIM-XIV-H — YUGOSLAVIA

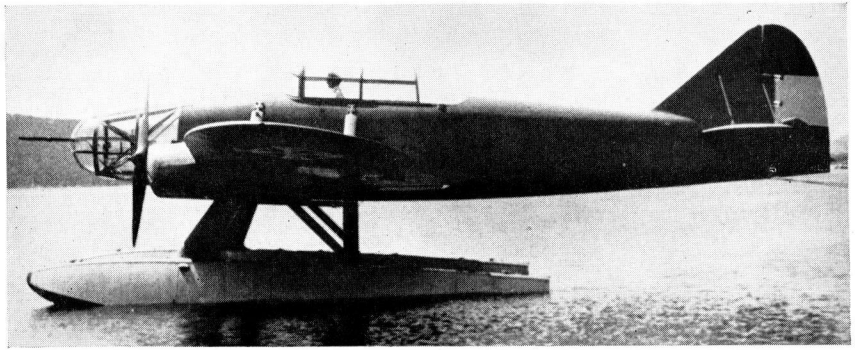
In 1930, the equipment of the Yugoslav Naval Air Service was appreciably more modern than that of the Royal Yugoslav Air Force, but within five years the bulk of its aircraft were either obsolescent or already obsolete. As a step towards remedying this situation, in January 1937 a new specification was issued for a twin-engined O.I. (*Obalski Izvidjač* or Coastal Reconnaissance) aircraft also capable of undertaking mine-laying, convoy escort and shipping attack rôles Several proposals were tendered by the aircraft industry and from these was selected the SIM-XIV-H projected by Sima Milutinovič and which, despite a simple and inexpensive wooden structure, appeared to offer a good performance. The highest priority was allocated to the construction of a prototype by the Rogožarski plant in Belgrade, and this flew for the first time on February 8, 1938, being the first Yugoslav twin-engined warplane of indigenous design.

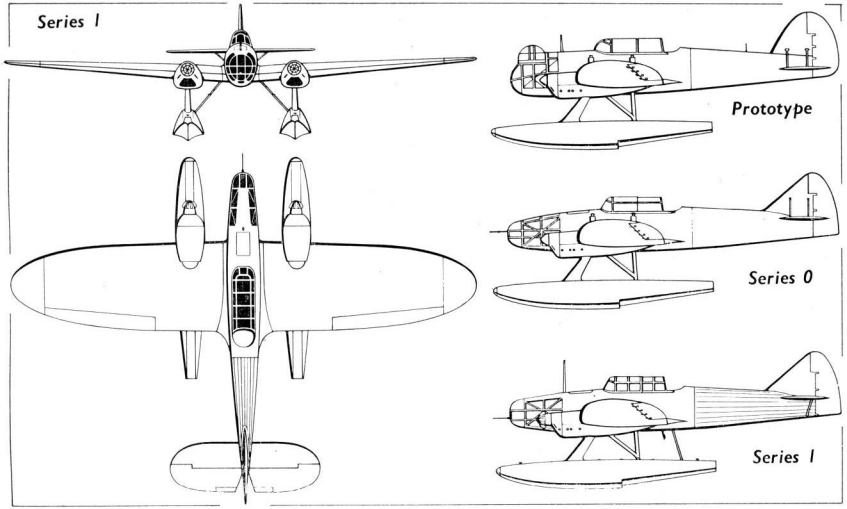
The SIM-XIV-H was a clean, low-wing monoplane with two Edo floats of Alclad attached to the engine nacelles and wing roots by steel-tube struts. The wing centre-section was rigidly braced to the fuselage by parallel struts, and the oval-section monocoque fuse-



(*Above and below*) *The SIM-XIV-H Series O, six examples of which were produced for the Yugoslav Navy.*

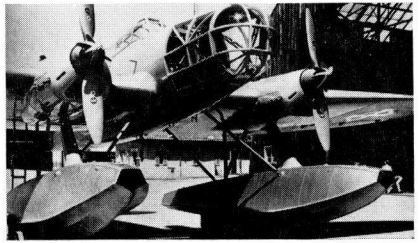
lage had an extensively-glazed nose section incorporating a rotatable gun turret housing a single 7.5-mm. FN-Browning. A similar gun was mounted in the observer's cockpit, and power was provided by two 240 h.p. Argus As 10C eight-cylinder inverted-Vee air-cooled engines. The SIM-XIV-H proved to be a pilot's aircraft in every respect, possessing outstanding handling characteristics, and Navy test pilots were delighted with the prototype.





Work was immediately initiated on a pre-production batch of floatplanes known as the Series O, and these differed from the prototype in several respects. The revolving nose turret was eliminated, the tailplane was raised, the vertical tail surfaces were redesigned, the cockpit framing was strengthened, and the wing root fairings were modified to eliminate a slight tendency to stall. Six Series O floatplanes were built, these being followed by six Series 1 aircraft which featured a fully cantilever wing, a fabric-covered welded-steel-tube rear fuselage, increased cockpit framing, revised tailplane bracing and 270 h.p. Argus As 10E engines driving two-pitch Argus-

The SIM-XIV-H Series 1 *ordered in* 1939.



Only six SIM-XIV-H Series 1 floatplanes reached the Yugoslav Navy before the German invasion, although a further twelve aircraft with more powerful engines were on the production line.

Schwarz airscrews.

The SIM-XIV-H Series 1 was extremely stable both in the air and on the water, it could perform limited aerobatics, and it could maintain altitude at normal loaded weight on one engine. It was extremely popular with its crews, and the capacious fuselage permitted the normal complement of three crew members to be raised to six for certain missions. A further production batch of twelve SIM-XIV-H Series 1 floatplanes was ordered by the Yugoslav Navy in 1940, these having 450 h.p. Argus As 410 engines and various minor modifications, and these had reached an advanced stage of construction at the time of the German invasion of Yugoslavia. Sima Milutinovič had also begun work on a landplane adaptation of the floatplane for use as a twin-engined pilot trainer, although this was never built.

Prior to the capitulation of April 17, 1941, the SIM-XIV-H floatplanes were operational over the Adriatic, and two succeeded in escaping from Yugoslavia, eventually reaching Allied bases in North Africa from where they flew reconnaissance sorties over the Mediterranean until one was destroyed in a typhoon and the other scrapped owing to the lack of spares.

Type: *Three-seat Coastal Reconnaissance Twin-float Seaplane.* **Power Plants:** *Two* 270 *h.p. Argus As* 10*E eight-cylinder inverted-Vee air-cooled engines.* **Armament:** *Two* 7.5-*mm. FN-Browning machine guns and one* 220-*lb. bomb plus two* 110-*lb. bombs or twelve* 27.5-*lb. bombs.* **Performance:** *Maximum speed,* 151 *m.p.h. at sea level; cruising speed,* 118 *m.p.h.; time to* 3,280 *ft.,* 4 *min.* 30 *sec.; service ceiling,* 14,240 *ft.; range,* 522 *mls.* **Weights:** *Empty,* 4,916 *lb.; loaded,* 7,386 *lb.* **Dimensions:** *Span,* 49 *ft.* 10½ *in.; length,* 36 *ft.* 8⅞ *in.; height,* 14*ft.* 8⅓ *in.; wing area,* 382.764 *sq. ft.*

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